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PROCEEDINGS OF THE FOURTH IUCN/SSC
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Jalu, the four year old male Sumatran rhino captured in Torgamba forest, Sumatra, enjoying his new ''quarters'' at the Ragunan Zoo, Jakarta.

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Forest conversion in progress, Torgamba, Riau, Sumatra.
Photographs by Syafii Manan.

PROCEEDINGS OF THE FOURTH IUCN/SSC ASIAN RHINO SPECIALIST GROUP MEETING

— A note from the Editors.

The Fourth IUCN/SSC Asian Rhino Specialist Group Meeting was held at the Ministry of Forestry Building, Manggala Wanabakti, Jakarta, from October 13 to 14, 1986.

The Meeting was convened by the Chairman of the IUCN/SSC Asian Rhino Specialist Group, Mr. Mohd. Khan bin Momin Khan in order to review the progress made since the last meeting that was held in Singapore in 1984, in the field of conservation and management of rhinos in Asia, and also to reach a consensus on what the priorities should be for the coming years. The emphasis was on the two species of rhinos in Southeast Asia, namely the Sumatran rhino *(Dicerorhinus sumatrensis)* and the Javan rhino *(Rhinoceros sondaicus)* whose prospects for long-term viability in the wild, are not as good as those for the Great Indian one-horned rhinoceros *(Rhinoceros unicornis)*.

The status of the Sumatran rhino was given particular attention in the light of the recent developments in Malaysia and Indonesia where much progress had been made in both *in situ* as well as *ex situ* conservation of the species. A most encouraging news was the discovery of some Sumatran rhino in Sarawak. Even quite small local populations are valuable and should be protected wherever practicable. On the other hand, in areas where the animals have absolutely no hope for survival, as in the case of Torgamba production forest in Sumatra, some animals were captured in a collaborative programme between the Directorate General of Forest Protection and Nature Conservation in Indonesia and the Howletts and Port Lympne Zoo Park in the United Kingdom in order to propagate the species in captivity in zoos. This points to the fact that the last refuge for the rhinos may require skillful management, both in nature as well as in captivity.

In the wild the rhinos are threatened by poachers throughout their range. The Asian rhino horn is of very high commercial value. A kg of rhino horn can fetch anything between US$ 4,000 to 9,000 in the black market. At such a price, the continued survival of the animals will always be at risk. The recent announcement that Singapore had acceded to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is most welcome and it augurs well for wildlife conservation in general. The use of substitutes in patent medicines should also be encouraged as a

measure to reduce the demand for rhino horn.

The Javan rhino faces the bleakest prospects for long-term survival on account of its small population size. It remains the rarest large mammal in the world. Its rarity alone does not allow any experimentation at the moment. Given the lack of experience in maintaining and breeding this animal in captivity, it was felt that it would be taking a big risk if some animals were to be captured for breeding in zoos.

There is an urgent need for a number of surveys to be carried out to determine the whereabouts of the viable populations and those that are "doomed". In the final analysis, the overwhelming emphasis of any conservation policy must be in the maintenance of forest cover over large areas uninterrupted by human settlements, where remoteness, density of cover and difficulty of terrain provide natural protection. The prospects for the long-term survival of the rhinos in Asia, although grim need not be hopeless. In this issue of RIMBA INDONESIA, we present the Proceedings of the Fourth IUCN/SSC Asian Rhino Specialist Group Meeting.

April 1987
Bogor, Indonesia

Syafii Manan,
Directorate General of
Forest Protection and
Nature Conservation,

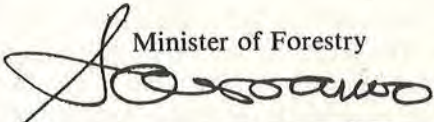
and

Charles Santiapillai,
World Wildlife Fund
Indonesia Programme.

DEDICATED
TO
THE HONOURABLE MINISTER OF FORESTRY
DR. SOEDJARWO

Dr. Soedjarwo
Minister of Forestry
Republic of Indonesia

MENTERI KEHUTANAN
REPUBLIK INDONESIA

MESSAGE

As a developing country, Indonesia's economy depends largely on the exploitation of its vast but finite natural resources. But an unbalanced economic development can deplete such a resource base on which the country's long term development ultimately depends. The pace of development in the recent decades has increased so much that a number of land development programmes have transformed enormous areas of forest into cultivated fields, leading to the disappearance of animals especially the large mammals such as the rhino, from their former habitats. We must therefore recognize the need to reduce the rate of deforestation and manage our natural resources more sustainably.

Three species of rhino occur in Souteast Asia, namely the Indian or Greater One-Horned Rhino, the Javan or Lesser One-Horned Rhino and the Sumatran Two-Horned Rhino. Throughout their range, the rhinos are in conflict with man and are therefore on the brink of extinction. Of the three species of rhino extant in Southeast Asia, the Javan and Sumatran rhinos face the bleakest prospects for long term survival. A combination of poaching and habitat loss has contributed to the rapid decline in number of these once common and widespread species. The high value of their horn makes them extremely vulnerable to poaching.

Indonesia has taken a number of measures to conserve the rhinos. These range from improvement of their habitats to increased anti-poaching efforts and tighter legislation. Lately the *in situ* conservation measures are being complemented by such *ex situ* measures as the captive breeding programme designed especially to safeguard those rhinos that are doomed in their present habitats as a result of the rapid conversion of the forests to other land uses. Such gene banks offer the possibility for returning the animals to the wild at a later stage. However, for any developing country, the most economical gene bank must surely be the proper management of the animals in their natural habitats.

Conservation problems are often rooted in the socio-economic conditions of the country. In Indonesia, conservation of natural resources must be seen in the context of the country's rapidly growing human population and its impact on this resource base. Conservation and development are inextricably inter-related. We must adopt a policy for the wise utilization of our natural resources so that we could continue to derive the benefits from such resources without eventually destroying them. This calls for the sustainable utilization of our natural resources.

The two species of rhino in Indonesia represent an outstanding component of our natural heritage, and so every effort must be made to ensure their continued survival in their natural habitats. In 1978, Indonesia acceded to CITES (Convention on International Trade in Endangered Species of Wild Flora and Fauna) which effectively banned the trade in rhino products. Nevertheless, poaching still remains a serious problem on account of the high commercial value of the rhino horn. The only long term solution to stopping the trade in rhino products depends on how successful we are in reducing the demand for them. There is an urgent need to educate the public to make them more aware of the conservation problems. The IVth IUCN/SSC Asian Rhino Specialist Group Meeting gives us reasons to be optimistic that international organizations would continue to assist us in our efforts to conserve the rhinos.

Minister of Forestry

DR. SOEDJARWO

WELCOME ADDRESS

Dr. RUBINI ATMAWIDJAJA
Director—General
Directorate General of Forest Protection
and Nature Conservation
Indonesia

Ladies and Gentlemen,

It is with great pleasure that I welcome you all today to this meeting of the IUCN/SSC Asian Rhino Specialist Group. I am particularly happy to note that the Chairman of this Group, Mr. Mohd. Khan bin Momin Khan has considered it appropriate to hold the meeting here in Indonesia at a time when much progress has been made in the field of both *in situ* as well as *ex situ* conservation of the rhinos.

The Indonesian archipelago — perhaps the largest in the world with over 13,000 islands — possesses an extremely rich and diverse flora and fauna that include such endangered species as the Javan and Sumatran rhinos. The plight of the Javan rhino has been attracting world wide attention since the early sixties when it was thought that only about 20 animals were surviving in Ujung Kulon National Park, situated at the western tip of Java. It is found nowhere else, and none survive even in zoos. Of the three extant species of rhino in Asia, it is the Javan rhino that faces the bleakest prospects for long-term survival because of its small population size that makes it very vulnerable to sudden perturbations in its environment. In an effort to save the rhino from an early, untimely extinction, the Directorate General of Forest Protection and Nature Conservation (PHPA) of the Ministry of Forestry, in association with the World Wildlife Fund (WWF) launched a conservation programme in 1967, as a result of which the number of rhino in Ujung Kulon National Park has more than doubled in the intervening years.

At the beginning of 1982 however, five animals (representing almost 10% of the total population at that time) were found dead in the Park, thereby emphasising their vulnerability to sudden catastrophes. The cause of their death still remains uncertain. Today, the Javan rhino has the distinction of being the rarest large mammal on earth!

In comparison to the Javan rhino, the Sumatran rhino seems to have fared reasonably well and currently, its population in Sumatra is estimated to be anything between 450 and 700. Nevertheless, threats to its continued

survival in the wild still remain. Poaching is rampant and habitat loss continues unabated. Once numerous throughout Sumatra, the animal has declined in number throughout its range. The conversion of primary forest to agricultural holdings is a particularly serious cause of conservation problems in Sumatra, and the rhino has been amongst the species most affected by it. Already a combination of high rate of human population growth and inappropriate land-use policies has squeezed the rhino out of many areas in Sumatra, and should such disruptive processes continue unchecked, the Sumatran rhino, like the Javan rhino will find both its range and numbers shrinking at a rapid rate.

But the situation in Indonesia, as far as the two species of rhino are concerned, although grim, is not entirely hopeless. Given the will and committment at both national as well as international levels, I am convinced that concerted action can be taken to halt the current trend. This meeting has been specially organised to review the current status of the rhinos, identify the threats (present as well as potential) to these animals throughout their range, and outline the strategies needed to ensure their long-term survival. The primary objective however must be the maintenance of as many individuals as possible in as wide a range of habitats as is feasible.

The captive breeding programme was proposed merely to deal with the rhinos whose habitat is either doomed or whose numbers are no longer large enough to maintain long-term viability. A good rhino habitat today is doomed if the area is already earmarked for other land-use. The agreement between the Republic of Indonesia and the United Kingdom (and later perhaps with USA as well) would allow for the capture of such doomed animals with a view to breeding them in captivity in zoos both here and abroad. We have already achieved substantial success in the capture of Sumatran rhino from one such doomed area in Sumatra, namely the Torgamba production forest. But we must always bear in mind that such captive breeding programmes are designed not to replace but reinforce the *in situ* conservation efforts of ours.

The rhino must have some place to live and something to eat. Both requirements are likely to be in even shorter supply in the years to come, in the light of the current demographic and development trends in Indonesia. The rhino should be regarded as a common property resource. It is a part of our natural heritage and its survival would depend not only on our determination and committment, but also on the level of international assistance that may be forthcoming in the future.. I conclude wishing you all, every success in your deliberations.

The Chairman of the Asian Rhino Specialist Group, Mr. Mohd. Khan bin Momin Khan, addressing the meeting.

Technical session in progress.

OPENING ADDRESS

Mr. MOHD. KHAN bin MOMIN KHAN
Chairman
IUCN/SSC Asian Rhino Specialist Group

Editors' summary :

Mr. Mohd. Khan thanked Prof. Rubini Atmawidjaja and went on to outline the activities of the Asian Rhino Specialist Group (ARSG) to date. At the Ist meeting that was held in Bangkok (Thailand) in 1979, the three species of Asian rhino, namely the Indian, Sumatran and Javan, were considered for discussion. The objective was to assess their status and prepare an Action Plan. The Chairman emphasised that viable populations were essential for long-term survival of any species. Reproduction must overcome any losses incurred by a population through natural mortality or poaching. He then went on to discuss the status of the Sumatran rhino *(Dicerorhinus sumatrensis)* which is found in Indonesia, Malaysia, Burma and Thailand (Fig. 1). This wide distribution of the species raises difficult problems for its conservation. In the proposals made in Bangkok in 1979, the main emphasis was laid on the collection of data on the species of rhino through research; protection of their habitats through legislation; regular monitoring of the populations to assess the fluctuation in numbers; promotion of measures that would improve the level of protection and reduce poaching; and a strict control on the trade in rhino products (horn, hide etc.).

The IInd and IIIrd meetings of the ARSG were held in 1982 and 1984 in Malaysia and Singapore respectively. At this IVth meeting in Indonesia, the main task was to review the progress made so far and outline the strategies needed for the future. In the Peninsular Malaysia, for example, information such as how many rhinos are present, where they occur, and what steps must be taken to improve their long-term survival are crucial. Today, thanks to the tremendous work so far carried out in Malaysia, rhinos are better known and understood than they were in 1979. There are more personnel to investigate into the rhino numbers and range. Viable populations of Sumatran rhino are present in Endau-Rompin and Taman Negara in Peninsular Malaysia. A small population is also present in Sabah.

In Thailand, the situation vis-à-vis the Sumatran rhino was critical in 1979 and therefore more surveys were recommended to be carried out in four areas. The situation still remains a matter for concern. Rhinos continue

to face considerable problems from a variety of causes in Indonesia. Habitat destruction, shifting cultivation and poaching still go on. In Sumatra, there are five areas where the Sumatran rhino is known to survive, viz. Gunung Leuser National Park, Kerinci-Seblat National Park, Barisan Selatan National Park, Torgamba production forest, and perhaps Kalimantan (although Dr. Nico van Strien doubts if the animal occurs in Kalimantan). As far as the Javan rhino *(Rhinoceros sondaicus)* is concerned, the Chairman emphasised the need to continue monitoring of the animals in Ujung Kulon National Park, and recommended that anti-poaching measures and the level of protection of the park be improved. In India, the Great Indian one-horned Rhinoceros *(Rhinoceros unicornis)* in comparison to the Javan and Sumatran rhinos, seems to be doing well. It is found in India, Nepal, Assam, West Bengal and Bhutan and in 1979, its number was estimated to be about 1,100.

At the IIIrd meeting of the ARSG held in Singapore in 1984, the main topic of discussion was what should be done with the doomed animals in the case of the Sumatran rhino? It was then decided to launch a programme to capture individual rhinos from doomed areas for breeding in captivity in zoos. Since then, Indonesia has captured five animals (3 males and 2 females), while Peninsular Malaysia captured five animals (all were females) of which one was sent to Thailand as a gift. The Chairman expressed his wish to exchange one female for a male from Indonesia. He also noted that a pair had already been sent from Indonesia to England to be bred in captivity at the Howletts and Port Lympne Zoo Park. Eventually, he hopes to have captive animals in Indonesia, Malaysia, Thailand, United Kingdom and the United States of America.

Note: In the brief discussion that followed the Chairman's address, Mr. Widodo Sukohadi Ramono, (Chief of Balai Konservasi Sumber Daya Alam II, Tanjungkarang, Sumatra) surprised everyone present by his declaration that he had seen some rhino dung in the Way Kambas Game Reserve recently! He was unable to confirm if it was definitely that of a rhino, but ruled out the tapir as a possibility. More surveyes are needed to confirm Mr. Widodo's report. The last Javan rhino was supposed to have been shot in this area in 1961.

Participants and Observers at the Asian Rhino Specialist Group Meeting.

Dr. Thomas Foose, Mr. Mahedi Andau, Dr. Charles Santiapillai and Mr. Raleigh Blouch, attending the tecnnical session.

THE JAVAN RHINO *(Rhinoceros sondaicus* Desm.) CENSUS IN UJUNG KULON NATIONAL PARK

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ABSTRACT

The Javan rhino census was carried out in Ujung Kulon National Park on April 14 - 18, 1984. It involved 47 people including 11 students from the Fakultas Biologi of the Universitas Nasional. The basic methods put forward by Schenkel & Schenkel (1969) were used in the field and in the tabulation of the results of the census. The census was carried out along 11 trails throughout the Ujung Kulon area. At the end of the census, the population size of Javan rhino was estimated to be 50 - 54. The footprints of three newly weaned rhino calves were also found. The most commonly encountered foot prints were those classified as young male/female adult category (74.83%). The composition of the footprint classess found in the census suggests that the population of Javan rhino in Ujung Kulon can be expected to grow further, provided no serious limitations arise. The results of the census also show the range and distribution of the rhinos. The distribution of the rhino in Ujung Kulon is obviously uneven. The biggest concentration of individuals occurs in the central part of the park. From the west of Gunung Payung complex to the tip of Tanjung Layar, relatively very few footprints were seen. The distribution extends eastwards to the Karang Ranjang area. This shows that the area that was empty after the death of five animals in 1981 - 1982 (PPA 1982, Sadjudin 1983) has been re-established as a range. In addition to the Javan rhino, a variety of other wildlife was also recorded from sightings during the census. Of the large mammals, the ones most frequently encountered were the Banteng *(Bos javanicus)* and a number of monkeys. The birds observed include fruit-eating species such as the Rhinoceros hornbill or Rankong *(Buceros rhinoceros)*, the Wreathed hornbill or Julang *(Rhyticeros undulatus)* and the Indian pied hornbill or kangkareng *(Anthracoceros coronatus)*. However, their numbers are unknown. A more comprehensive survey of the Ujung Kulon National Park is recommended.

Fig.1. Map showing the past (stippled areas) and present (shaded areas) distribution of the Sumatran rhinoceros *(Dicerorhinus sumatrensis).*

Sources : Nico J. van Strien. 1985. The Sumatran Rhinoceros — *Dicerorhinus sumatrensis* (Fisher, 1814) — in the Gunung Leuser National Park, Sumatra. Indonesia; its distribution, Ecology and Conservation. Doorn.

1.0 Introduction

In the past, the distribution of the Javan rhino covered a wide area that included Bangladesh, the eastern parts of India, Burma, Thailand, Laos, Kampuchea, Vietnam and Malay Peninsula. It may also have lived in the southern parts of China, along the Mekong and Songkoi rivers. In ancient Indonesia, it was found in Sumatra and Java.

In 1934 Frank shot a male Javan rhino at Karangnunggal, near Tasikmalaya. The mounted specimen is now kept in the Zoological Museum in Bogor. It was recorded as the last Javan rhino found outside the Ujung Kulon area (Hoogerwerf 1970, Sadjudin 1984). The drastic decline in number of this once widely distributed animal in Java began at the turn of the 20th century. Indiscriminate hunting practices in the past were responsible for the elimination of the rhino throughout Java. Today the animal is found only in the Ujung Kulon National Park (Fig. 2) where its population growth is limited owing to the relatively small habitat.

The ecology and behaviour of the Javan rhino has been studied in the past by several people (Schenkel & Schenkel 1969, Hoogerwerf 1970, Sadjudin 1984, and Ammann 1986). During his time (1935 - 1955) Hoogerwerf reported frequent incidence of hunting. In 1955, Hoogerwerf estimated the population of the rhino to be about 35. Poaching seems to have continued up to the time Schenkel & Schenkel (1969) initiated their studies. They estimated the population to be only 25 at that time. Their findings focussed international attention on the plight of the Javan rhino. In an effort to save the rhino from getting extinct, the Government of Indonesia and the World Wildlife Fund cooperated in taking effective measures to strengthen the protection of Ujung Kulon National Park. Guard posts were established, and extra personnel were recruited and equipped with the means such as boats, ground vehicles and fire arms, to deal with the poachers. Ujung Kulon was therefore heavily patrolled, and census of the animals was carried out annually. These efforts enabled the rhino to increase in number over the years, although slowly.

Management of the Javan rhino requires a knowledge of the number surviving in the Park. The present census was carried out with the view to estimate just how many rhino were left in Ujung Kulon, and also to determine the fluctuation in their number over the years. Since five animals died in 1981 - 1982 — all in the same area — after a heavy rainfall, the present census too was carried out soon after the rains in order to determine what might have contributed to their death. It is hoped that the findings would be used as a basis for subsequent census as part of the management of the rhino in Ujung Kulon.
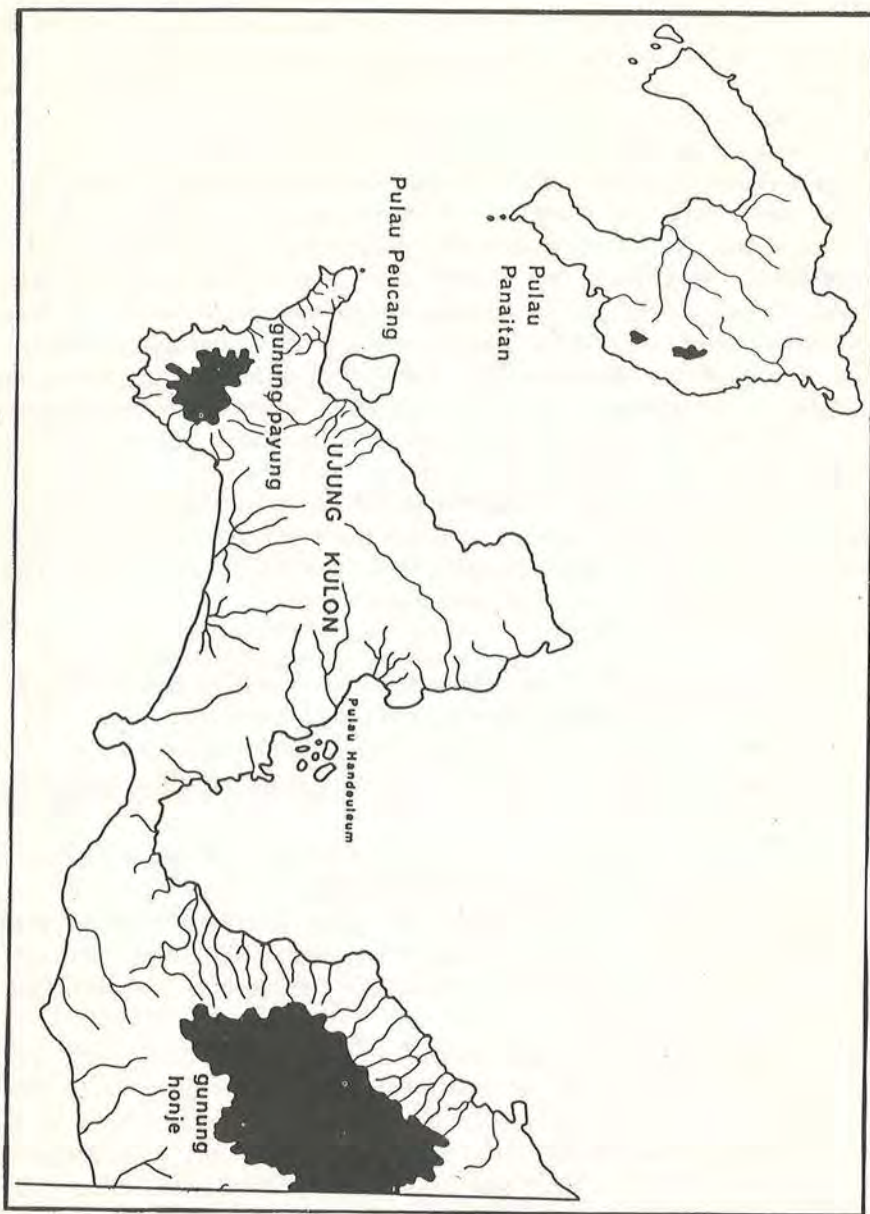
Fig. 2. Map showing the Ujung Kulon peninsula and the islands of Pulau Peucang and Pulau Panaitan. Shaded areas represent the 500 m altitude.

2.0 Methods and Constraints

Many difficulties have to be overcome before a successful census of the rhino can be carried out in Ujung Kulon (Schenekel & Schenkel 1969, Hoogerwerf 1970, Sadjudin 1984). The difficulties arise primarily due to the solitary and wandering nature of the animal itself. The Javan rhino perfers to live in dense vegetation in the forest. In addition, its low population size makes frequent sightings of the animal extremely difficult. The present census was carried out from 14 - 18 April 1984 by a group of 47 field workers, along 11 trails in the area where the rhino was known to be present (Sadjudin & Djaja 1984). To simplify the tabulation of footprints found during the census, only those found along the trails were noted. The trails were set in a north-south direction. Nevertheless the topography precluded a systematic survey of the whole area. This led to difficulties in plotting the positions of the footprints on a map. However, points of observation can still be identified in each trail with reference to previous reports (Sadjudin & Djaja 1984).

Rain was another factor that made the census operation difficult. It rained very heavily every day for more than an hour after which footprints were difficult to locate and estimating their 'age' was even more difficult. The main activities during the census are given below :

2.1 The planning of the whole field programme including that of transporting the men and material across the sea to Ujung Kulon.

2.2 The actual census operation itself which was carried out by 47 fieldworkers (including 11 students from the Fakultas Biologi, Universitas Nasional).

2.3 Census was carried out along 11 trails that were established in a north-south direction by 11 groups of fieldworkers.

2.4 Each group consisted of at least one guide, an observer to record the footprints and note the sightings of the animal and other wildlife. In addition a group must have at least four fieldworkers to carry enough food to last four days.

2.5 The fieldworkers recorded the measurements of the footprints, noted their direction, and estimated the 'age' of each footprint found along the trails. They also recorded other signs of rhino activity such as, the presence of mud holes, rhino wallows, remnants of food, droppings and urine. Other wildlife was recorded only from actual observations (except in the case of the leopard where only its foot prints were observed).

2.6 All field data were compiled. Footprints of the Javan rhino of all sizes were then plotted on a 1 : 75,000 scale map and were analysed. It was assumed that all footprints of the same measurement and found occurring in the same direction belonged to the same individual. It provided

an estimate of the minimum and maximum numbers in addition to the average number in the area.

3.0 Census results

Once all the footprints were plotted on a map, they were checked with those found along the trails. Then on the basis of the movement of each individual according to the measurements, the direction and age of the footprints, estimates of the minimum and maximum size of the population were made (Table 1). The average number of rhino in Ujung Kulon was found to be about 52. This was based on the analysis of 147 footprints of various sizes and two of undertermined size. Table 2 provides the age group classification and it was based on the analysis of the footprints according to the methods given by Schenkel & Schenkel (1969).

To know if the rhino population has increased or decreased, it is necessary to follow its growth pattern since the time of the publication of Schenkel & Schenkel (1969). Although the figures shown in Table 3 give no guarantee for the continued survival of the rhino in Ujung Kulon, they are nevertheless a useful barometer to gauge the effects of successful anti-poaching measures. During the period when Ujung Kulon was strictly patrolled, there were no reported incidents of loss of rhino through poaching. Deaths occured then mainly from disease and old age (PPA 1982, Sadjudin 1983).

4.0 Areas of population concentration

The distribution of the Javan rhino was found to be uneven. There were no footprints found along trail I — the area from Ciramea river westwards to the Tanjung Layar. In the Gunung Payung complex and its surroundings, a few footprints thought to belong to three animals were found below the northern slope, while in the summit of Gunung Payung itself, no footprints were found. Even in the central part of Ujung Kulon cape, there seemed to be an uneven distribution in the footprints. In the Gunung Telanca area which extends northwards to the coast, an eastwards to the Nyiur and Jamang swamps, not many footprints were seen. Footprint concentrations were found in the southern part of Gunung Telanca extending eastwards to the area of Citadahan, Cikeusik and Cibandawok. Footprints were also found in the north i.e near Tanjung Balagadigi, Cigenter and Cihandeuleum, and in the east to points beyond the Karang Ranjang area. In the easternmost area, footprints were found in Pangarok, close to Kalejetan. In addition, footprints of four animals were found in Tanjung Tereleng area.

5.0 Conclusion

Talbot (1960) reported that the population of Javan rhino in Ujung Kulon in 1958 was about 12 - 14. In 1937, it was estimated to be about 25 (10 males and 15 females), while in 1955 it was thought to have increased to about 30 - 35 (Hoogerwerf 1970). These two reports were not made on census carried out simultaneously and in a short time interval, but rather were based on long-term field observations. The first reliable estimate of the population was made by Schenkel & Schenkel (1969). After their first census, the number was thought to be between 21 and 28. Subsequently, tighter measures were taken to control hunting and so the population increased to 50 - 54. Looking at the figures from the annual census since 1980 (Table 3), the number of Javan rhino appears to have declined recently. This decline can be attributed to the six animals that died between 1980 and 1983 (PPA 1982, Sadjudin 1984).

A more important aspect of the census was to determine the occurrence of reproductive activity on the basis of the number of rhino calf footprints observed. During the census, footprints of three newly weaned calves were noted. According to Sadjudin & Djaja (1984) these calves were still with their mothers. In 1981 there were seven calves categorised as being under two years of age (Sadjudin 1984). They are expected to be in the 'mature young' category today. On the basis of the census, the Javan rhino population in Ujung Kulon appears to have a good age composition. The most predominant age class (74.83%), is the adult female or young adult male category (Table 2). This raises the expectations for a high reproductive performance. However, studies carried out by Sadjudin & Djaja (1984) indicate that the reproductive rate was rather low in 1980 - 1983, about 3 - 4%.

Compared to the 1967 figures, the population today has doubled. This means about half the Javan rhinos are 17 years old (or older, counting out the possibility of age-induced mortality of rhinos in 1967 - 1983). Whith the death of the five rhinos in 1981 - 1982, all in the same area, it was thought that the population had reached its optimal limit (Schenkel as quoted in PPA 1982, Sadjudin & Djaja 1984). However, the exact cause of their death still remains unresolved. Therefore there is a need to carry out regular census studies in Ujung Kulon so that fluctuations in numbers can be documented and appropriate measures taken in time to save the Javan rhino. Along with the conditions of the population, it is also necessary to determine the range and distribution of the rhino in Ujung Kulon. This is important as it enables us to find areas preferred by the animals. Since the time of Schenkels' (1969) and Hoogerwerf's (1970) publications the distribution of rhino has been studied and reported by Sadjudin & Djaja (1984) whose major finding is the uneveness of the rhino in Ujung Kulon. This uneven distribution is caused by a number of factors such dry topography, vegetation, and the alternation of wet and dry seasons. The uneven distribution of the footprints supports the findings of Sadjudin & Djaja (1984), who divided Ujung Kulon

cape into four areas of rhino concentration. Each area has a different population density. The present census found no footprints in area I, the western part of the cape (Trail I). In Trail II, only a few footprints were found thought to belong to three animals. Javan rhino was thought to be concentrated in Areas II and V of Sadjudin & Djaja's report (1984).

After the death of rhinos in the eastern part around the Karang Ranjang region, only recently footprints of rhino have been found once again. An adult female was seen along Trail X, and an adult male was observed in Trail IX (Tanjung Balagadigi). This indicates that the areas once avoided by the rhino are once more being utilized by them. The observation is important since it raises the question as to whether range expansion is a sign of incresed population size and therefore necessitates the provision of more feeding grounds within the Park itself. It has been stated that the Javan rhino prefers flat lands and gentle slopes (Sadjudin & Djaja 1984), which is confirmed by the present census findings. On Hommel's vegetation map (1983), the Javan rhino concentration areas appear to coincide with areas of vegetation of the types preferred by the animals. Other factors such as deep swamps and steep hills in the Gunung Payung complex also limit the distribution of the animals (Sadjudin & Djaja 1984).

In addition to the Javan rhino, wildlife such as birds, reptiles and other mammals were also recorded. More detailed studies are needed to establish if there is indeed any serious competition between the benteng *(Bos javanicus)* and the rhino since they are sympatric in Ujung Kulon. They are known to feed on at least some of the common vegetation (Djaja *et al.*, 1982).

6.0 Recommendations

6.1 Population stabilization needs to be observed. Special studies on the ecological competition between banteng and rhino must be carried out. The next census must estimate the population size of the banteng too.

6.2 All the available data must be collated and studied carefully in order to carry out the management of Ujung Kulon more effectively and along sound ecological lines.

6.3 A more comprehensive record of the Park's wildlife should be made.

6.4 Census work in Ujung Kulon must be carefully planned in advance, especially its timing. The most appropriate times are the end of the rainy season and the beginning of the dry season. At other times, it would be difficult to measure the footprints on the substrate.

Table 1. Estimates of the minimum and maximum numbers of Javan rhino in Ujung Kulon. April 14 - 18, 1984 (Based on the size of footprints of fore and hind legs).

No :	Footprint size (cm.)	Minimum	Maximum
1	20/21	1	1
2	21/22	2	2
3	23/24	3	4
4	24/25	6	7
5	25/26	11	11
6	25/27	2	3
7	26/27	10	10
8	27/28	8	9
9	28/29	4	4
10	28/30	1	1
11	29/30	2	2
Total		50	54

Table 2. Population composition of Javan rhino at the time of the census (April 14 - 18, 1984). It is based on the various estimated age-classes.

Footprint classes	I	II	III	IV	V	Total
Forefoot size	20	20 - 23	24 - 25	26 - 28	29 - 30	—
Estimated age (yrs)	½	½ - 1	1 - 2	♀ adult ♂ subadult	♂ adult largest ♀	
Minimum number estimated	—	3	9	31	7	50
Recorded number of footprints	—	3	20	110	14	147
Percentage	—	2.04	13.61	74.83	9.52	100
Maximum number estimated	—	3	11	33	7	54

Table 3. Population growth of Javan Rhinoceros in Ujung Kulon from census results (1967 - 1984)

Year	minimum	maximum	average	source
1967	21	28	24.5	Schenkel & Schenkel (1969)
1968	20	29	24.5	idem
1969	22	34	28.0	PPA
1970	—	—	—	no census
1971	33	42	37.5	PPA
1972	40	48	44.0	PPA
1973	38	46	42.0	PPA
1974	41	52	46.5	PPA
1975	45	54	49.5	PPA
1976	44	42	48.0	PPA
1977	44	52	48.0	PPA
1978	47	57	52.0	PPA
	46	55	50.5	Ammann (1980)
1979	—	—	—	no census
1980	54	62	58.0	PPA
	57	66	61.5	Ammann (1980)
1981	51	77	64.0	PPA
	54	60	57.0	Sadjudin *et al* (1981)
1982	53	59	56.0	PPA
1983	58	69	63.5	PPA
1984	50	54	52.0	Sadjudin & PHPA (1984)

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DISCUSSION

BLOUCH : wanted to know if there was any evidence of serious competition between the banteng and the Javan rhino since the former was said to be numerous ?

WIDODO : commenting on the information given in Table 3 of Haerudin Sadjudin's paper, pointed out that since 1980, the number of Javan rhino appeared to be either stable or on the decline and therefore wanted to know if there were any signs that the habitat was deteriorating ?

HAERUDIN : attributed the decline in number to the sudden death in 1981 - 1982 of five animals plus the one killed by poachers in 1983. He also mentioned that the rhinos were seen up to Kalejetan — an area where even the water buffalo from the nearby kampung wander into.

RHINO TRAPPING IN MALAYSIA

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1.0 HISTORY

In 1975, Rodney W. Flynn, a Biologist who studied the ecology of the Sumatran rhino *(Dicerorhinus sumatrensis)* in Endau-Rompin, attempted unsuccessfully to capture the animal by using corral or surface trap. Then, once again in 1985, the Department of wildlife and National Parks (DWNP) used corrals to capture the rhino in Tenggaroh, Johor and Bukit Gebok, Pahang. These traps however were found to be ineffective at both sites. In November 1985, after the Sumatran Rhino Trust Agreement (van Strien 1985) fell through, the DWNP set up an *ad hoc* committee on Rhino Capture. Most of the committee members (Table 1) have had wide experience in the field and in handling large mammals, particularly elephant, deer and seladang. Among the resolutions made at the Ist meeting are :

1.1 The capture of individual rhinos in threatened or doomed habitats.

1.2 The capture of individuals for breeding in captivity at the Zoo in Malacca and in the Sungai Dusun Reserve.

1.3 The development of an effective method of capture.

1.4 The training of personnel in the Rhino Management Unit (RMU).

The RMU is given the task of executing the decisions or recommendations made by the committee.

2.0 AREAS FOR CAPTURE

Areas in priority I : Threatened or doomed areas with no hope for survival for the rhinos.

a). Bukit Gebok and Ulu Atok, Pahang

b). Tenggaroh and Kambau, Johor
c). Sungai Dusun, Selangor.

Areas in priority II : Less threatened areas.

a). Sungai Yong and Sungai Depak, Kelantan
b). Kenyir, Trengganu.

Table 1. *Ad hoc* committee on Rhino Capture in Malaysia

Member	Designation/Specialization
Mohd. Khan bin Momin Khan	Chairman
Louis C. Ratnam	Head/Management Division
Zainal Zahari Zainuddin	Veterinarian/Malacca Zoo
Zaaba Zainal Abidin	Wildlife Management Unit
Syariff Daim	Elephant Management Unit
Mohd. Tajuddin Abdullah	Rhino Management Unit

Table 2. Trapping sites and number of traps

Sites	No.	of traps Dimension	Notes
Bukit Gebok	6	8' x 8' x 8'	Six tapir and an elephant fell into the trap
Kambau	10	8' x 8' x 8'	Six tapir were caught. One rhino escaped in January 1986 Deactivated in September 1986
Ulu Atok	4	8' x 8' x 8' 10' x 4' x 8'	One rhino escaped (pit size: 8' x 8' x 6') One motorcyclist and cattle fell into the pits
Tenggaroh	1	10' x 4' x 8'	One female rhino was caught Deactivated.
Sungai Dusun	4	10' x 4' x 8'	One female rhino was caught Pit was deactivated. Cattle fell in

3.0 TRAPPING TECHNIQUE

During the initial stage of trapping in November and December 1985, a rather primitive pitfall trap was designated and set up at Bukit Gebok, Kambau, and Ulu Atok. The pit measured 8' x 8' x 6' (length x width x depth). As a result of the poor design, the capture team faced severe setback when two animals escaped from the pitfall traps in Ulu Atok and Kambau. The animals were able to excavate the earth on the wall and gather the leaves and twigs used as shock absorber to help in their escape. Subsequently a new

design was made with major modifications in width and depth and reinforced wall. The new pits measured 10' x 4' x 8' with strong plywood wall and were used in Ulu Atok, Tenggaroh and Sungai Dusun. Finally, two rhinos were caught in the newly designed pits (Table 2) and the animals were sent to the Malacca Zoo at Air Keroh.

The pitfall trap had some major problems associated with it. First of all, where the soil had poor drainage, flooding and landslide usually occured. The pit must be closed when flooded at 1.5' and stronger wall should be built to prevent the pit from caving in. Secondly, the interference from non-target species: there were incidents of tapir, elephant, cattle and even human beings trapped in the pits (Table 2). There is nothing that can be done to prevent such non-target species from falling into the pits. Even sign boards erected for the benefit of man, went unnoticed. Thirdly, the duration of waiting time spent before a rhino is trapped is unpredictable. A pit at Ulu Atok trapped a rhino within 12 hours from the time it was completed and activated, but at the sametime, there are some traps that are even now not at all effective in trapping either a rhino or a non-target animal.

Therefore, the site selection is very important and it is the factor that determines the success or failure of a pitfall trap. The trapping team should be properly trained to distinguish between ordinary trails used by animals and rhino highway or major trail. The cosmetics of the pit surface is also important. After the trap is set, the area must look as natural as it was before. Finally, there are problems from porcupines and termites that chew the timber and plywood. Woody materials should therefore be treated prior to use.

4.0 COST

According to Mohd. Samsudin (1986) the cost of building a 10' x 4' x 8' pit in terms of materials and salaries for workers is MS$ 1,426.40 and MS$ 1,534.66 respectively (Table 3). The cost is based on the use of highly trained workers who have had good experience in building such traps in June 1986. When however, the programme was first started in November 1985, at a time when there was none with any experience, the total cost was more than MS$ 5,000.00 per pit.

Table 3. Cost of building a 10' x 4' x 8' pit

Material cost		
Materials (Timber, Plywood etc)	MS$ 311.40	
Digging equipment (reusable)	MS$ 225.00	
Transport crate (reusable)	MS$ 890.00	
Total		MS$ 1,426.40
Manpower cost (40 days)		
Salaries (8 x 5 days)	MS$ 684.66	
subsistence allowance	MS$ 850.00	
Total		MS$ 1,534.66
Grand total		MS$ 2,961.06

5.0 FUTURE ALTERNATIVES IN RHINO CAPTURE TECHNIQUES

There are few alternative techniques in the rhino capture that can be considered :

i. the use of drugs.
ii. the use of Stephenson box trap

Drugs are effectively used on other rhino species such as the Great Indian Rhinoceros. The dosage could be adjusted for use on the Sumatran rhino. The box trap is found to be useful in capturing animals such as the white-tailed deer in North America. The box design can be improvised to capture the rare Sumatran rhino.

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THE CONSERVATION OF THE SUMATRAN RHINOCEROS *(Dicerorhinus sumatrensis)* : A SITUATION REPORT AND PROPOSAL FOR FUTURE DIRECTIONS

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1.0 SITUATION REPORT

There are now nine Sumatran rhinos in captivity in the world - two at Howletts & Port Lympne Zoo Park, UK; two in Indonesia (one at the Jakarta Zoo in Java, and the other at Torgamba Base Camp in the Riau Province in Sumatra), four at Malaysia's Malàcca Zoo, and one at Bangkok Zoo in Thailand. The sex ratio among these individuals is 6 : 3 in favour of the females. The only potential breeding couple actually together in the same location now is the pair at Howletts & Port Lympne Zoo Park — 'Torgamba' the male and 'Subur' the female.

Up to about November 1985, there were only two of these endangered rhinos in captivity in the world, the first since the last recorded captive Sumatran rhino in the west died in 1972, at Copenhagen Zoo, Denmark; these two were females located at Malacca Zoo, captured in 1984 and 1985 respectively. Clearly then, the potential for captive breeding as an approach to Sumatran rhino conservation has vastly improved within the past year. It will continue to improve providing the world community remains committed to this particular approach. Providing also the various parties concerned are responsible and cooperate with each other on an international basis to set up breeding pairs with benefit to the world population in mind, rather than operating on any selfish nationalistic basis.

The prognosis for such cooperation is good. Besides the three parties already mentioned — the Indonesia and Malaysian authorities and the Howletts & Port Lympne Zoo Park in UK — the American Association of Zoological Parks and Aquariums (AAZPA) may also participate in the Sumatran rhino breeding project in the future. The AAZPA will bring to the project access to high technology methods such as artificial insemination, embryo transplant and transfer etc., and further funds — Howletts looks set

to inject about US$ 1 million by the end of the project and the AAZPA could match that figure.

Our optimism for the future should however remain cautious: we should not lose sight of the basic problems: the long-term conservation of the species. The Sumatran rhino has been declared one of the world's 12 most endangered species by the International Union for Conservation of Nature and Natural Resources. In the wild, there are only perhaps about 800 Sumatran rhino left worldwide, and about 700 of these are in Sumatra itself (Fig. 1). Many of these are individuals too isolated from one another to breed, owing to deforestation associated with clearance for agriculture, industry or human settlements.

For example, although there is a small population in Taman Negara (the National Park), Pahang state, probably the last truly viable breeding population in Peninsular Malaysia numbers about 20 - 30 and inhabits the Endau-Rompin forests of Johor state in southern Malaysia. Signs are that these southern forests are by no means secure from violations as yet, despite energetic campaigning by local conservation groups. As for East Malaysia, the situation is even worse, with only one small potentially viable population extant, out of a total of perhaps 30 - 40 Sumatran rhino, possibly belonging to a Bornean subspecies. Poaching seems to have been culling this total at a rate of something like 3 or 4 a year.

Only six reserves anywhere in the Sumatran rhino's modern range — Sumatra and Malaysia, perhaps parts of Thailand, Indochina and Burma too (Fig. 1) — are known to offer the required "carrying capacity", estimated at 1000 ha for every rhino. This would imply a necessary total of 70,000 ha. (700 km2) for an optimally viable population of 70 rhino. With Sumatra itself, the situation is only slightly better, with only three viable breeding populations now in existence. The Torgamba area in which our joint Howletts and Indonesian government capture operation has chosen to work, between the villages of Bakambatu and Tanjungmedan in Riau province, exemplifies the problems. In this area, a patch of about 30,000 ha of forest has been surrounded by oil-palm plantations, except for a large swamp on its eastern side. Logging roads intersect the forest in all directions, allowing access to illegal settlers, and disrupting the rhinos' usual patterns of movement. Within this area, a population of about 20 rhino has become marooned without access to the forested hinterland.

Prof. Rubini Atmawidjaja, Director-General of the Directorate of Forest Protection and Nature Conservation (PHPA) of the Ministry of Forestry, has had to intervene personally to freeze logging in this area for the next three years. Nothing could illustrate the problem more dramatically than the fact that the two Sumatran rhino our operation captured in June 1986 - the male "Napangga" on the 15th, and the female "Subur" on the 22nd - both had serious leg wounds inflicated by trappers' snare-wires, the wires still deeply embedded in the flesh. There seems little doubt that had we not captured these two animals, they would have died a lingering death

from gangrene. As it is, the male is still fighting recurrent infection despite careful treatment thanks to Howletts' specially air-flown Director and vet, Dr. Tom Begg.

It seems likely that there are still more Sumatran rhino to be found in two or three other unprotected pockets of forest within Sumatra: reports have been received from about 50 km north of Pekanbaru and from the hills to the west of Torgamba itself. As human activity intensifies in these areas, we may expect the incidence of poaching to increase. The Sumatran rhino is in crisis.

2.0 SUMMARY OF SUMATRAN RHINO CAPTURE OPERATION

1982: First discussions between Indonesian authorities and Howletts & Port Lympne Zoo Park, UK.

October 3 - 4, 1984: *Ad hoc* Sumatran rhinoceros meeting convened by the IUCN/SSC in Singapore discusses pros and cons of captive breeding.

May 24, 1985: The joint agreement signed by Indonesian Government and Howletts & Port Lympne Zoo Park, UK.

August 1985: Howletts-Indonesian joint project goes ahead.

September 1985: Base camp constructed at Torgamba.

September — October 1985: Survey of rhino trails, under the supervision of capture expert, Tony Parkinson, working with Indonesian rangers and foresters in training.

November 25, 1985: young male "Torgamba" found in pit trap, and transferred to a pen the next day. Almost hairless at first, he grew a long coat of hair in captivity. Transferred after eight weeks to one of two specially constructed base camp paddocks, 400 m2.

January 23, 1986: Adult female found in stockade trap, in panic. She died the same day, apparently from a cerebral haemorrhage induced by self-inflicted injuries when banging herself against the stockade fencing in an effort to escape. Such violent behaviour is unusual for the Sumatran rhino but this was a bitter reminder that so delicate an operation cannot be expected to be roses all the way.

March 24, 1986: A second young male "Jalu" caught in pit trap, later moved to Jakarta Zoo, where Howletts' staff are training Indonesians to manage and breed the Sumatran rhino.

April 1986: "Torgamba" travelled 200 km by truck to the port of Dumai for transfer to a ship bound for Singapore. After a three-day voyage, he transited at Singapore's Changi International Airport and left on April 4, on a Singapore Airlines Combi (Passenger-freight) Big Top jumbo jet for Manchester airport, UK, where he travelled another seven hours by lorry to Howletts in Kent.

June 15, 1986: Capture of third male, "Napangga" in pit trap — still at base camp partly because of infected snare wound on leg. Snare wire

successfully removed without anaesthesia.

June 22, 1986: Capture of a female, ''Subur''. Infected snare wound on leg successfully treated and snare-wire removed under anaesthesia by Dr. Begg.

August 25, 1986: ''Subur'' moved to Singapore, this time via Airfast Charter plane to Seletar Aerodrome, then to Changi Airport for SIA flight to Manchester, UK, as with ''Torgamba''.

To date all the animals are doing well in captivity. Perhaps the most valuable lesson we have learned, for this operation and for future ventures, is that the pit trap, while dangerously susceptible to flooding during the monsoonal rains, is less stressful for the Sumatran rhino than the stockade type, perhaps because it is darker and movement is more restricted inside it. However, once caught in a pit trap, the animal must be moved to a holding pen nearby as soon as possible.

We are treading pioneer, and at times treacherous ground, for little is known of the Sumatran rhino's habits, least of all its breeding habits, nor of how easy it will be to re-introduce the animal into the wild. The burden of responsibility for the survival of a threatened species weighs heavily on our shoulders and we are acutely aware that the eyes of the conservation world are upon us. We are also aware that on our success hinges the future of many other threatened species which could similarly be captive bred: prime examples of course are the extremely rare Javan rhino, on which subject I am presenting a separate paper at this conference, as well as the Southeast Asian wild ox or Kouprey.

3.0 PROPOSALS FOR THE FUTURE

All isolated ''doomed'' rhinos in Sumatra should be translocated into captivity or into suitably protected areas. However, we believe captive breeding to be safer, from the point of view of monitoring disease, poaching and territorial competition, amongst other likely problems. Captive breeding also allows closer observation so that valuable data on the animals' habits can be gathered for application to better management of populations still in the wild.

Maximum committment in terms of energy, funds, manpower etc. should be made to the protection of the three remaining viable populations in Sumatra, at Gunung Leuser, Gunung Kerinci-Seblat and at Barisan Selatan.

Efforts to conserve natural habitats still available to rhinos in the wild must be continued, indeed strengthened and accelerated. At no time must we lose sight of our ultimate objective: the re-introduction of the species into the wild.

Public relations is important, both within the rhino's homelands and worldwide — every effort should be made to increase public awareness of

the rhino's plight, by publishing press articles, leaflets, books, photos and films etc. We intend to fulfil all these objectives in time: the well known Indonesia based wildlife photographer, Alain Compost, is currently working with us to document all aspects of the capture and breeding operations in both still and movie photography. We would appeal to the parties concerned not to be so secretive as to arouse public suspicion, where skilled public relations and proper liaison with sympathetic press men could swing public opinion in our favour.

The institution of studbook keeper is already beneficial for the better coordination of the captive breeding colony — a Sumatran rhino studbook will be published, with additional relevant articles on conservation, husbandry, ecology etc.

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Mr. John Aspinall, Chairman, Howletts & Port Lympne Zoo Park.

The Staff of Jakarta Zoo, Indonesia.

Mr. Tony Parkinson, Director, Field Operations.

Dr. Tom Begg, Director, Howletts & Port Lympne Zoo Park.

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Singapore Airlines, Singapore.

DISCUSSION

RUBINI : pointed out that the pit traps proved to be more effective than the surface traps, and asked to what extent the captive breeding programme would be successful? He added that the Indonesians lack the expertise and the necessary funds, and wanted to know how these could be overcome. He inquired from the speaker how long it would take before the progeny from captive breeding programme could be re-introduced into the wild ?

NARDELLI : mentioned that he would like to extend the capture programme to other areas where the rhino was doomed. The AAZPA in his opinion should join hands with Howletts and Port Lympne Zoo Park (HPLZ) as soon as possible and 'inject more funds and high technology into the programme'. He further recommended the development of buffer zones. He welcomed Mr. Syafii Manan's proposal to catch rhinos in the province of Jambi, Sumatra.

WIDODO : emphasised the need to improve the present guard system in the reserves in sumatra. He felt that with proper protective measures, the prospects for the long-term survival of the rhino can be improved. He further pointed out that giving too much attention to captive breeding was not wise for fear that people might forget that three were animals in the wild too! He expressed his fears that local people, ignorant of the reasons for the capture of the rhinos, might become tempted to follow suit on their own. In view of this, he urged that conservation education be extended to grassroot levels especially in areas where the capture programmes were going on, in order to inform the people at large what exactly was being done.

NARDELLI : expressed his committment to the *in situ* conservation of rhino. However, he added that at the present time, the priority must be on financing operations to deal with the doomed populations. In response to WIDODO's argument, he pointed out that there was a distinct difference between what the HPLZ was doing in Torgamba and what was being done by the poachers elsewhere. While the poachers capture and kill the rhino, the HPLZ capture programme was designed to save the rhino and not to kill it. He further added that more often than not, poaching was carried out by professionals to whom no amount of conservation education was likely to bring about a change of attitude.

SANTIAPILLAI : quoting Mr. Aspinall's estimate (as mentioned at the Singapore Meeting in 1984), "In Indonesia, 400,000 ha of forest are demolished per annum", wanted to know how optimistic one could be if such a trend were to continue into the future, that proper habitats would be available for the re-introduction of rhino from captivity ?

FOOSE : pointed out that it would be difficult to predict what the future might hold. Therefore, he emphasised that while all efforts should be taken to protect the rhino in the wild, other options too must be made available to safeguard the species.

RUBINI : expressed his optimism that all the forests in Indonesia would not be completely destroyed. Nevertheless, he was concerned about the ultimate success of any re-introduction programmes, in the light of the situation concerning the orang utan in Indonesia. He mentioned the efforts of Dr. Birute Gladikas in rehabilitating the orang utan with the view to releasing the animals at some future time into the wild. But so far this operation had not been successful and so he feared that similar difficulties might also arise in the case of the rhino. Reference was also made to the Bali Starling.

Mr. Francesco Nardelli and Dr. Thomas J. Foose, representing The Howlett and Port Lympne Zoo and the American Association of Zoological Parks and Aquariums (AAZPA) respectively during the Technical session.

Mr. Jansen Manansang, owner of The Indonesian Safari Park, seen here with Dr. Chira Meckvichai and Mr. Mohd. Khan bin Momin Khan, during their visit to the Safari Park in Cisarua, about 20 km south of Bogor.

Mr. Francesco Nardelli and Dr. Thomas J. Foose, representing The Howlett and Port Lympne Zoo and the American Association of Zoological Parks and Aquariums (AAZPA) respectively during the Technical session.

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CONSERVATION OF THE SUMATRAN RHINOCEROS IN SABAH, MALAYSIA

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1.0 REVIEW OF THE PREVIOUS GROUP MEETING

The contents of the last Asian Rhino Specialist Group Meeting (28 June - 4 July, 1982) report relating to Sabah are reproduced here for easy reference.

Silabukan, Sabah : Present situation: For practically the whole Silabukan rhino range, the Sabah Foundation has a loging consession. At present, several logging teams are operating.
Evidently, this causes serious disturbances to the rhinos. In addition, some time ago, a rhino was shot by loggers. The objectives in the interest of rhino conservation are :

(a) to stop illegal hunting of rhinos,
(b) to save as large an area as possible from being logged,
(c) to select patterns of logging to which the rhinos are able to adapt.

Evidently these objectives necessitate negotiations with the Sabah Foundation and supervision of the loggers' activities by guards.

Proposed actions : (see project 1972 — Sabah, Conservation of the Sumatran Rhinoceros in the Silabukan area).

First priority : Danum Valley, Sungai Imbak, Kuamut, Gunung Lotung. These remote areas have never been the concern of a biologist or conservation survey. They might still harbour rhinos.

Proposed actions : To survey the areas mentioned and to take the steps best suited for rhino conservation. It was also suggested that rhinos might survive in the Sabah—Kalimantan (Indonesia) border area, and a joint survey was therefore proposed, possibly with the support of WWF/IUCN and ASEAN.

The specific suggestions made at the 1982 meeting have been carried out, but much progress has been achieved on other fronts, as circumstances relating to rhino conservation in Sabah have changed considerably since that meeting. The comments in this paragraph are placed in perspective in the following sections below.
Poaching (illegal hunting) of rhinos continues wherever they occur, and logging in the Silabukan area has continued. Two 4-wheel drive vehicles have been purchased through IUCN/WWF Project No: 1972 to assist Rangers of the Game Branch, Sabah Forestry Department in protecting rhinos in the Silabukan region. A short survey has been done in Danum valley, since access to this area is much easier now than in 1982. The other regions mentioned (Sungai Imbak, Kuamut, Gunung Lotung and the Sabah—Kalimantan border area) are still the remotest parts of Sabah and primarily for this reason have not been surveyed. Instead, it has become apparent that rhinos are still present in a number of much more accessible areas where they are under the greatest threat, and so attention has focussed on these accessible areas. There is actually no immediate urgency to conduct thorough surveys in the most remote areas where rhinos are relatively safe.

2.0 NEW DATA ON DISTRIBUTION OF RHINO IN SABAH

The Game Branch (= Wildlife Section) of the State Forestry Department is the Government Agency responsible for the conservation of wildlife including the rhinos in Sabah (except in the Parks, which cover about 3% of Sabah, and in which there is no evidence of any rhino). Other duties which the Game Branch is obliged to perform, prevent any major survey effort for rhinos except in special cases (see section 3.0), and instead personnel working in appropriate areas (logging camps, new plantations etc) are encouraged to report any evidence of rhinos to the Game Branch Staff.

Records of the presence of rhinos received over the past five years are shown in Fig. 3, under four somewhat arbitrary but not mutually exclusive categories.

(a) Tabin Wildlife Reserve (see sections 3.0 & 4.0) contains the largest known concentration of rhinos remaining in Sabah. Roughly one quarter of the reserve's boundary is shared with oil palm and cocoa plantations, the remainder with contiguous logged dipertocarp forest in which rhinos undoubtedly occur.

(b) Places marked "evidence of 1 or 2 rhinos remaining" indicate where rhinos or their footprints have been found by the authors, Game Rangers or others who, when interviewed, appeared reliable.

(c) Places where rhinos are believed to have been killed between 1980 - 1985 are marked, on the basis of reports from various sources (all unproven
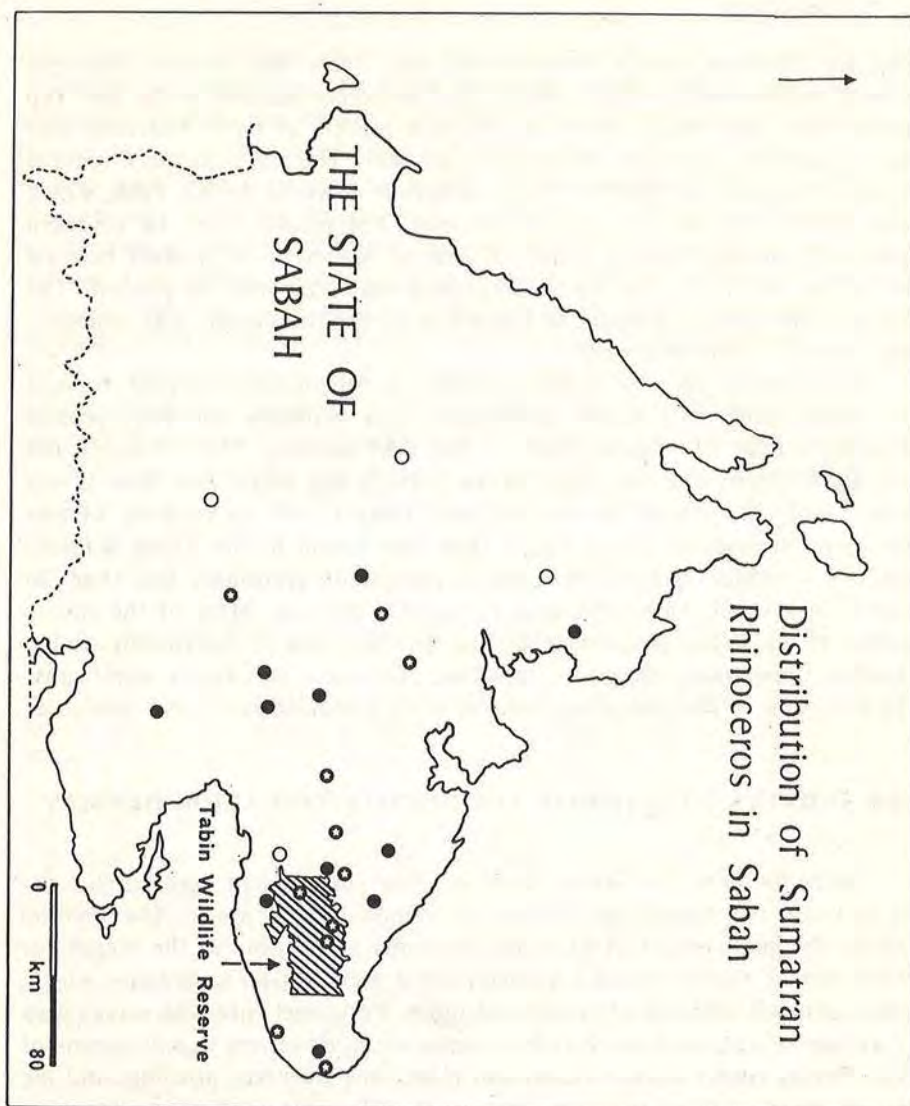
Fig. 3. Map of Sabah showing the distribution of the Sumatran rhinoceros.

● Evidence of 1 or 2 rhinos remaining

* Locations where there is evidence that the animals were killed between 1980 - 1985

o Unconfirmed but probably reliable accounts of the presence of rhinos

but considered to be reliable). It may be that more rhinos still survive in the vicinity of these locations.

(d) Places marked "unconfirmed reports" represent mixed sources of information.

The two northern records shown on the map under this category represent general regions within which rhinos have definitely occured in the past (up to the '60s), and from where unconfirmed reports of both footprints and rhino poaching have come within the past year. The three southern records represent reports of rhinos or their footprints received during 1986, which seem reliable but are yet to be confirmed. The record from the southern slopes of Gunung Lotung (south of central Sabah) is of interest because the size of the footprints reported suggests that tapir may be present. The dung of this animal, brought to Sandakan by the discoverer, was undoubtedly that of a rhino or a tapir.

On summing up : the records of rhinos in Sabah collected over the past five years indicate a wider distribution and probably an even greater abundance than was thought likely at the 1982 meeting. These data do not indicate however, that the status of the rhino is any better now than it was then. Firstly, despite all the new records, there is still no evidence of any one concentration of rhinos bigger than that found in the Tabin Wildlife Reserve — which consists of a small population (probably less than 20 adults) in a small, vulnerable area (about 123,000 ha). Most of the rhinos appear to be living isolated from one another, not in potentially viable breeding populations. Secondly, poaching pressure is still highly significant. Thirdly, some of the rhinos are living in areas scheduled for forest clearance.

3.0 SURVEYS TO ESTIMATE THE RHINO POPULATION DENSITY

Since the previous Group Meeting, three surveys had been carried out to estimate the population density of rhinos in two areas. The method entails the involvement of as many personnel as possible in the search for footprints of rhinos within a predetermined area and in accordance with a predetermined schedule of routes and times. Personnel enter the survey area in groups of four and work from a series of work camps in sub-groups of two. Survey routes cover streams and ridge tops wherever possible, and are spaced on an average, at about 2 km apart. All evidence of rhinos is recorded, in particular measurements of fresh footprints. The data are used to calculate the minimum number of animals present in the survey area. Methods are similar to those used by rhino researchers in Peninsular Malaysia and Sumatra.

Personnel from the Game Branch of the Sabah Forest Department, the Sabah National Parks, the Department of Wildlife & National Parks (Peninsular Malaysia), Sabah Foundation and the World Wildlife Fund

(Malaysia), all participated in a survey conducted in an undisturbed forest in the Silabukan area in august 1982. Definite evidence was found of the presence of seven adult rhinos within an area of 28,000 ha. Additional surveys conducted before and after the main survey, and ambigous data from the main survey, indicated that up to 14 animals, including one juvenile were living in and around this area. A survey of the same region, but covering a smaller area centred on the Tabin watershed, conducted by the staff from the Game Branch, the SRWCC and WWF Malaysia in June 1986 revealed a higher density of rhinos than was indicated in 1982 (see section 4.0).

Early in 1986, the staff of Sabah Foundation reported the sighting of two rhinos in Malua Forest Reserve, an area within the Foundation's concession about 25 km north of Danum Valley Conservation Area (see section 5.0). Game Branch staff subsequently confirmed the presence of rhino in this area, and in April 1986, a survey of the type conducted in Silabukan/Tabin was carried out in the upper Malua/upper Bilong drainage by staff from the Game Branch, SRWCC and WWF Malaysia. The survey found definite evidence of only one rhino and footprints indicating the possible presence of three adults in the 13,000 ha. The Malua/Bilong area is in forest (scheduled for logging) contiguous with the Danum Valley Conservation Area, and so the Danum-Malua rhinos may in fact, be one contiguous population.

4.0 ESTABLISHMENT OF TABIN WILDLIFE RESERVE

A part of the region referred to proviously as "Silabukan" was gazetted by the State Government in March is estimated at 120,000 ha. Within the Reserve are seven virgin jungle reserves totalling about 2009 ha., which in practice may be regarded as part of Tabin. The purpose of Tabin is to conserve viable wild breeding populations of Sabah's large terrestrial mammals such as elephant *(Elephas maximus)*, rhino and banteng or tembadau *(Bos javanicus)*.

Over 90% of the Reserve has been selectively logged or allocated for logging. Formerly, the Sabah Foundation (Sabah's largest logging concession-holder) held 100-year logging rights over half the area of Tabin. In 1983, the Foundation relinquished those long-term rights, and it was expected that logging in the reserve would cease in 1987 or 1988. An area of 8616 ha in the middle of the reserve has been designated as the "core area" where logging is not permitted. The purpose of the "core area" (designated in 1984) was to provide a refuge for the rhinos that are displaced by the logging activity nearby. A survey conducted in June 1986 (see section 3.0) found evidence to suggest that this purpose has probably been realised. To quote the conclusions from a report :

"At least six rhinos were using the 'core area' of Tabin Wildlife Reserve and the adjacent, undisturbed forest (an area of about 11,700 ha) in

June 1986. All of them were adults or nearly so; no evidence of juvenile rhinos was found. The population density of rhinos in 1986, in the undisturbed forest adjacent to the 'core area' is estimated at 1/2,000 ha. This is the highest density yet recorded in Sabah. The population density of rhinos in the same area in August 1982 was probably significantly lower, possibly only half the density as in 1986 *

* The survey method was the same in both years, but in 1982 the survey covered about 28,000 ha, took 5 teams and 8 days spread over a 12-day period; while in 1986, the survey took 3 teams and 7 continuous days.

The most likely cause of the apparent higher population density after a four year period is that the rhinos are using the 'core area' more intensively than previously because of logging pressure from the vicinity."

A management plan has already been prepared for Tabin, and is currently being printed. Many of the suggestions contained in the plan are geared to the conservation of the rhinos. Two key factors are :

(i) the establishment of a reserve headquarters (a site has already been selected on the western boundary and it takes 2h to drive to it from Lahad Datu Town.

(ii) the general upgrading of the Game Branch of the Sabah Forestry Department.

There is good evidence from Tabin and elsewhere that rhinos can live and breed exclusively in logged forests. It is believed that the presence of at least seven natural mineral sources within Tabin may be an important reason for the rhino's relatively high population density in the area, despite poaching pressure. If the level of poaching can be kept very low (which will be feasible once logging ceases), then there is no reason why rhino numbers should not increase several folds.

5.0 DANUM VALLEY CONSERVATION AREA

Long before the importance of Tabin was recognised, at least two survey reports had recommended that the Danum Valley area of the Upper Segama River in eastern Sabah be declared a wildlife conservation area, especially for large mammals. Following a biological survey in 1976, a WWF-Malaysia report recommended that Danum Valley be gazetted as a National Park. This was not to be since the area lies within the Sabah Foundation's 100-year logging concession, and the Foundation was unwilling to relinquish it.

Since the 1982 Group Meeting, Sabah Foundation has officially designated Danum Valley (42,755 ha) as a Conservation Area in its long-term management plan for its concession, in which no logging will be allowed. A road has been constructed to meet the eastern boundary of the Conservation

Area, and there are several buildings at the site including permanent staff quarters, two classes of visitor accommodation, laboratory and meeting room. Many people and research institutions,both within and outside Malaysia, have expressed interest in conducting research at Danum Valley, and several projects are underway.Thus, Danum Valley has evolved as a major new field research Centre in Southeast Asia.There is evidence of the presence of several rhinos in the area, but no large scale survey of the type outlined in section 3.0 has been organised for Danum Valley.

The protection afforded to Danum Valley by the presence of a research station, the fact that the area is a part of a much bigger forest block (Sabah Foundation's concession) and the discovery early in 1986 of the presence of rhinos in a forest some 25 km to the north (see section 3.0) indicates the value of this area to rhino conservation.

6.0 POACHING

Between 1981 and 1984, the Game Branch obtained reports of at least two rhinos being killed annually in Sabah. Except in one case in 1981, there was insufficient evidence for any prosecution. There has been no report of any death of rhinos from early 1985 to date. It is not known if this apparent decrease in rhino poaching might be related to the frequent publicity within Sabah during this period regarding rhino conservation (gernerated chiefly from public discussion over the plans for breeding rhinos in captivity, see section 8.0). Possibly, either poachers are more careful now, and reports are not reaching the Game Rangers; or poachers have reduced their activity, fearing a greater likelihood of detection and prosecution than was the case before. The latter scenario is more likely, as Sabah being a small state, the likelihood of rhino poaching being reported will be high. In addition it is conceivable that despite more records of rhinos in recent years, the number of rhino has in fact decreased so much that constant hunting efforts are now giving poor returns to the poachers.

Although there are no reliable reports of poaching since early 1985, there are still verbal reports and at times even direct evidence of poaching (in the form of unexpected human footprints in hitherto inaccessible areas inhabited by rhinos). Poaching remains a serious threat to the long-term survival of the species in Sabah. No evidence has been obtained of rhino parts or products being on sale in Sabah since the last meeting. This is not surprising, since these are quickly smuggled out of the state. Ethnic Chinese traders in Sabah are known to maintain close links with their counterparts in Hong Kong and Singapore.

7.0 PROTECTIVE MEASURES

A comprehensive series of amendments to the Sabah legislation relevant to rhino conservation were drafted earlier this year, and are currently under review. Suggested amendments include a mandadtory minimum jail sentence for anyone found in possession of rhino part or product. At present heavy penalties apply only to hunting of rhino which normally cannot be proven, while penalties for possession of parts of rhino are not commensurate with the black-market value of those parts. Passage of new legislation is unlikely until 1987. The Game Branch of the Sabah Forestry Department remains too small to provide adequate protection for rhinos. No new posts have been created for the Game Branch recently. New posts created under SRWCC (see section 8.0) are expected to be transferred to the Game Branch at some stage, however, thereby increasing significantly the guard capability in Tabin and other important areas.

8.0 THE SABAH RHINO & WILDLIFE CONSERVATION COMMITTEE

In 1985, the Sabah Government formed the Sabah Rhino & Wildlife Conservation Committee (SRWCC) in response to the need for urgent measures to save the endangered Sumatran rhino in Sabah. The committee was given a grant of MR 3,000,000 and the responsibility of translocating or capturing isolated individuals for captive breeding in cooperation with the Game Branch of the Forestry Department.

DISCUSSION

RUBINI : pointed out that there might still be some rhino in Kalimantan (especially in the eastern part) despite earlier reports to the contrary. He was particularly anxious to know what measures were being taken to protect such an important conservation area as the Tabin Wildlife Reserve in Sabah ?

ANDAU : agreed with Prof. RUBINI and disclosed that there were good indications for the presence of 2 - 4 Sumatran rhino in Sarawak, in particular along the Sarawak/Kalimantan border. As far as the Tabin Wildlife Reserve was concerned, he pointed out that a number of measures were being taken to save this area and its fauna. The boundary was being demarcated properly, but the task of protecting the reserve still was paramount. There were no staff based permanently at the reserve, but it was being patrolled by personnel from the nearby stations. About MS$ 400,000 had been allocated to develop this reserve and for the recruitment of personnel. It was hoped that the AAZPA would still get involved. But the State Government was more anxious to see that local people took on the initiative in the capture/breeding of rhino. Some degree of collaboration

between Sabah and AAZPA was welcome especially in training local personnel and for the provision of financial assistance.

ROEDJAI : discussed the possibility of rhino being still found in East Kalimantan. In 1985, he pointed out, when Prince Bernhard of the Netherlands visited Indonesia, an area of 1.2 million ha was set aside as a reserve between the State of Sabah (Malaysia) and Kalimantan (Indonesia). Such a trans-border conservation area could be jointly protected by both countries.

MANAN : wanted to know whether habitat loss or poaching posed the greatest threat to the long-term survival of the rhino.

ANDAU : pointed out that the selective logging need not be incompatible with rhino conservation. But he added that in Sabah, poaching would seriously affect the rhinos remaining. Logging operation indirectly help the poachers in that they open up forests (along the roads) thereby providing easy access for the poachers to enter the hitherto inaccessible areas. Furthermore, a number of home-made firearms were still available in Sabah. The rhino according to Mr. ANDAU was very valuable either dead or alive: valuable when dead to the poachers, and valuable when alive to the conservationists. He also commented on the presence of specialised gangs of poachers operating in Sabah with impunity.

WIDODO : wanted to know that system of logging was practised in Sabah ?

ANDAU : Selective logging was used in Sabah. Relogging of an area had been stopped. First logged forest could be a useful habitat for the rhino since it is a browser. If the forest was logged only once, Mr. ANDAU pointed out that it provided an excellent habitat as it regenerated, and so, the rhinos were more likely to repopulate such areas.

ON THE EFFORTS TO BREED THE SUMATRAN RHINO *(Dicerorhinus sumatrensis)* IN CAPTIVITY IN INDONESIA

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SUMMARY

In order to conserve the Sumatran rhino *Dicerorhinus sumatrensis* (Fisher, 1814), the Governments of the Republic of Indonesia and the United Kingdom entered into an agreement to breed in captivity, four pairs of animals from the Torgamba production forest in Riau, Sumatra. Two pairs of the rhino were to be sent to the Howletts and Port Lympne Zoo Park in England, while the others were to be sent to the Ragunan Zoo in Jakarta. Efforts to breed the rhino under captive conditions in the Ragunan Zoo were made since the arrival in May 1986 of a 2.5 years old male called "Jalu" that was caught in Torgamba on 25 March 1986. From the initial observations on "Jalu" it become clear that the animal could easily adapt itself to the cage conditions in captivity. The animal became very tame within the first two months. The cage in which the animal was kept measured 25 x 30 m. Within the cage itself, the conditions were made to simulate as much as possible the animal's natural habitat. A shelter was provided which consisted of a resting compartment and also places for drinking, feeding and wallowing. The daily activity of "Jalu" was monitored. "Jalu" was fed with a variety of leaves from 14 species of plants such as *Artocarpus integra, A. champeden, Psidium guajava, Sondoricum koetjape, Nephelium lappaceum* and *Manilkara* sp. In addition, the animal was given fruits and vegetables. The initial results indicate a healthy growth.

1.0 INTRODUCTION

The efforts to conserve the Sumatran rhino *Dicerorhinus sumatrensis* (Fisher, 1814) by breeding some in captivity were implemented through a joint collaborative programme between the Governments of the Republic of Indonesia and the United Kingdom. These efforts are important from the point of Nature Conservation in Indonesia. This cooperative venture is a reflection of the growing public awareness of conservation of wildlife in Indonesia.

The policy of the Indonesian Government in pioneering and developing the breeding of wildlife in captivity is based on the desire to achieve a number of development objectives such as :

(a) to maintain and enhance the existence of wildlife and so prevent their untimely extinction

(b) to increase the wildlife populations in order to obtain an added value in the form of rational and continuous utilization.

(c) to increase the productivity of land especially of the critical land that is unsuitable for agriculture.

(d) to provide increased job opportunities.

(e) to increase the capability of the Zoological Gardens in wildlife conservation.

In Sumatra, at present the forest vegetation that forms the habitat for the rhino can be classified as one of two types : either conservation forests such as those found in Gunung Leuser National Park, Kerinci—Seblat National Park, Barisan Selatan National Park, Berbak Game Reserve or Production forests such as the one in Torgamba in the lowlands of Riau province. A part of Torgamba forest is currently being converted to oil palm plantation.

In general, the population of rhino in conservation forests can be expected to increase compared to those that are found in production forests, where threats such as poaching and habitat loss are serious. In view of these threats, the aim of the captive breeding programme is to breed doomed animals *ex situ* in the Zoos, such as the one in Jakarta. The purpose of this exercise is to save the doomed animals and to re-introduce the captive population into the wild at a later stage to replace those that are killed by poachers. This paper reports the initial efforts in preparation for such a scheme in the Ragunan Zoo in Jakarta.

2.0 ECOLOGY OF SUMATRAN RHINO

Detailed information on the animal's biology and ecology is limited. The Sumatran rhino *Dicerorhinus sumatrensis* (Fischer, 1814) is known locally as "badak kerbau" and is a Perissodactyl herbivore. It is the smallest

of the extant rhinos. The body length (from head to tail) ranges between 250 - 280 cm; shoulder height is from 110 - 150 cm, and the maximum weight is 1000 kg. The skin is quite smooth with thin black hair. The pointed and oval head has two horns: the front horn lies above the eyes. The front horn in females is about 150 mm in length and the one behind, 50 mm. In the males, the horn can be three times as long as that in females.

2.1 HABITAT

Sumatran rhino can live in lowlands as well as in the mountains. It prefers dense forests which provide sufficient food, water and shade. Although basically an animal of the primary forest, it has adapted well to a habitat in the transitional area between primary and the more open secondary forests. It frequents river banks far away from human settlements.

2.2 BEHAVIOUR

The Sumatran rhino is nomadic, solidarity and nocturnal. In order to obtain its food, the animal travels over quite an extensive area. The distance covered each day could be as high as 7 km and the total area covered may, on an average be 10 km2. In the field, the animal has been observed to feed on more than 100 species of plants. It eats parts such as leaves, flowers, fruits and twigs. The animal prefers among others, plant such as *Glutea renghas* (rengas), and *Laportea stimulans* (pulus). The animal frequents sources of mineral water for drinking. It feeds usually very early in the morning and at nightfall. The animal rests during most of the daytime, prefering to wallow in the shade. The rhino usually spends several days in one place before moving to another area. While moving about, it has the habit of spraying its urine as a marker and as signal to other rhinos, especially during mating season.The rhino has an acute sense of hearing and smell, while its vision remains poor. In times of danger it can run really fast. The animal however is not as aggressive as the African species.

The Sumatran rhino is solitary, and stays with its mate only during the breeding season, which is usually in August. The animal can reproduce from the age of 4 years up to 20 years of age. The gestation period is about 7 - 8 months but it can be as high as 12 - 14 months according to van Strien (1985). One young is produced which is suckled by the mother until it is 4 years old. The mother does not mate while the calf is suckled.

3.0 BREEDING IN CAPTIVITY

According to the agreement made between Indonesia and United Kingdom, four pairs of Sumatran rhino from the Torgamba production forest were to be bred in captivity. Two pairs were to be sent to the Howletts and

Port Lympne Zoo Park in England, while the other two pairs remained in Ragunan Zoo, in Jakarta. Currently there is only one animal (a young male) in Ragunan Zoo.

3.1 CAPTURE AND TRANSPORTATION

The animal was caught in a pit trap in Torgamba, after which it was kept for a week in a pen near the site of capture so as to let it gradually become adjusted to the new environment. After this initial period of adaptation, the rhino was brought to Ragunan Zoo by truck. In transit, the animal was kept in a narrow compartment to prevent it from moving freely. The animal travelled with its head facing the front of the truck. En route, it was given sufficient food and water as was done when it was kept in the holding pen. Leaves of the 'jackfruit' *(Artocarpus* sp.) and 'petai cina' *(Leucaena leucocephala)* were obtained easily on the way. To maintain the humidity inside the cage, the animal was doused with cold water every two hours.

3.2 BREEDING CAGE

The breeding cage was constructed inside the Ragunan Zoo at a site far away from the main exhibiting areas. The cage measures 8000 m2 and has 5 units, with a door connecting one unit with the other. A corridor separates these units and links these units with the breeding cage. It also functions as an observation room and clinic and is equipped with some medical equipment. The cage was designed so as to simulate as much as possible the animal's natural habitat, with ample vegetation to provide cover and shade. The whole unit includes a shed, wallowing area, source of drinking water and a cage to treat the animals.

3.3 METHOD

The rhino is caged alone as long as it does not show any obvious inclinations to mate. Each cage holds one rhino. As soon as signs of reproductive activity are seen, the door connecting the animal's cage is opened to let a pair meet and mate. After mating, the animals are separated and kept in cages. Food and water are provided from outside in the morning, noon and in the afternoon. The food consists of a compromise between what the animal prefers in the wild and what is actually available nearby. To improve the nutrition, fruits and vegetables are also added.

4.0 IMPLEMENTATION

The rhino was caught on 25 March 1986. The first cage at the Ragunan

Zoo, houses this animal (a young male) since 27 May 1986. The cage measures 25 x 30 m and is made of concrete 40 cm thick and 100 cm high. Atop the wall is an iron fence 60 cm high. The inner wall is made smooth in order not to damage the rhino's skin. Inside the main cage is a shed (3 x 4 m). The floor is made of reinforced concrete and covered by an asbestos roof. Columns are made of iron pipes, 10 cm in diameter. The cage in the inner court is provided with a water trough 4 x 6 x 0.8 m, and a wallowing area 2.5 x 3.5 x 0.5 m. Inside the cage can be found vegetation, large and small, comprising species such as *Eugenia malaccensis, Bambusa* sp. (Bamboo), *Psidium guajava* (guava) and *Musa paradisiaca* (banana). In addition, the shrubs consist of *Imperata cylindrica* (alang alang), Widelia *trilobata, Chromolaena odorata* etc.

The second unit cage measuring 47 x 47 m is at the right of the first one and is connected by a door. The vegetation within this cage consists of species such as, *Lucuma nervosa, Mangifera odorata, M. foetida, Bambusa* sp., *Nephelium lappaceum, Cocos nucifera, Eugenia malaccensis, Psidium guajava, Albizia falcata, Acacia multijuga,* and *Musa paradisica.* The shrubs consist of *Pennisetum purpureum, Philodendron undulatum, Imperata cylindrica, Diffenbachia* sp., *Chromolaena odorata, Widelia trilobata,* and other grasses.

4.1 OBSERVATIONS ON "JALU"

So far five Sumatran rhinos have been captured from Torgamba forest (3 males and 2 females). The female that was caught on 23 January 1986, died soon afterwards and so there are only four animals surviving. Of the four, one pair has been sent to England, one male to Ragunan Zoo, while the other is still being looked after in Torgamba base camp. The male rhino that is in Ragunan was caught on 25 March 1986 and was named "Jalu" by the Director General of Forest Protection and Nature Conservation. It was brought to the zoo on 27 May 1986.

Results of the observations that were made on "Jalu" from the day of its arrival in Ragunan, to the end of September 1986 are as follows :

On entering the cage, "Jalu" was restless, running around the cage trying to escape. After sometime however it calmed down and finally settled near the water trough. Then it began to eat the leaves and fruits of various plants that were offered. On 29 May 1986, it was 200 cm long, and 100 cm in height. The animal was extremely curious.

At night, its feeding time was irregular so that it had only very little sleep. After one and a half months, it became so tame that its keepers could ride on it. Its daily activities are as follows: Between 0600 - 0700 h, it defaecates in the water trough, and wallows in the water. Then it seeks some shelter and feeds on the leaves provided. In the meantime, the trough is cleaned and fresh water supplied. At 0730 h, it feeds on fruits

and then goes to wallow again for hours. At 1100 h, it goes back to the shelter and feeds on twigs and leaves. After eating, it wallows again. At 1400 h, it is fed with fruits and vegetables. Then it walks around for 20 m and wallows again. Usually it eats at 2100 h and goes to sleep afterwards. Sometimes the rhino awakes between 2300 and 0100 h, walks about for 15 m and finally goes to sleep until 0600 h.

While being cared for in the cage, the animal did not show any fear of the frequent thunder and lightning. To date, there are no signs that the animal has reached sexual maturity. The animal was measured once again on 22 September 1986. The new measurements are: body length 206 cm, height 120 cm, length of head 50 cm, length of front horn 75 mm, the rear horn 45 mm, circumference of body 226 cm, length of ear 20.5 mm, and tail length 60 cm.

5.0 FOOD AND FEEDING

When the animal arrived in Ragunan Zoo, it was given several kinds of leaves. Each day the preferred species were recorded. To date, the animal has fed on the leaves and twigs of 14 species (Table 1), of which some are preferred. viz., *Artocarpus integra, A. champeden, Hibiscus* sp., *Xylopia glauca,* and *Ceiba pentandra.* However, these were restricted in an effort to let the animal get used to other species as well. The animal ate almost all the fruits and vegetables such as papaya, banana, cucumber, pineapple, cashew, guava, jackfruit, citrus, mango, apple, carrot, long beans, cabbage, lettuce, spinach etc. The fruits and vegetables were chosen because of their easy availability and low cost. "Jalu" consumes 34 kg of leaves and twigs, 14 kg of fruits and about a kg of vegetables in a day.

6.0 DISCUSSION

The animal has shown that it can adapt well to cage conditions. The personnel in Ragunan Zoo with their previous experience on other large mammals (e.g: elephant, tiger, tapir, orang utan etc) are confident that rhinos can be maintained successfully and bred in captivity. So far good results have been obtained in rearing "Jalu". The animal became tame within 2 months. It grew well during the four months it spent in captivity (it increased its body length by 6 cm, and its height by 20 cm). However, there were also problems such as the danger of communicable diseases being transmitted to the animal from outside.

Table 1. List of plant species eaten by the Rhino ("Jalu") in captivity.

No.	Local name	Scientific name	Parts eaten
1	Nangka	*Artocarpus integra*	leaves, fruits, twigs
2	Sawo	*Manilkara* sp.	do
3	Jambu bili	*Psidium guajava*	do
4	Kecapi	*Sandoricum koetjape*	do
5	Rambutan	*Nephelium lappaceum*	leaves & twigs
6	Sawo manila	*Achras sapota*	leaves, fruits, twigs
7	Cempedak	*Artocarpus champeden*	leaves & young twigs
8	Alkesa	*Lucuma nervosa*	leaves, fruits, twigs
9	Buni	*Antidesma bunius*	leaves & young twigs
10	Waru	*Hibiscus tiliaceus*	do
11	Salopa	*Xylopia glauca*	leaves, fruits, twigs
12	Randu	*Ceiba pentandra*	leaves & young twigs
13	Dadap raja	*Erythrina* sp.	leaves & twigs
14	Pule	*Alstonia* sp.	Leaves & young twigs

7.0 CONCLUSIONS

7.1 The cooperation between Indonesia and United Kingdom in the establishment of a captive breeding programme for the Sumatran rhino represents a new effort to conserve the wildlife in general.

7.2 Initial results in Ragunan Zoo appear promising.

7.3 The Sumatran rhino is being reared in captivity in conditions that simulate as much as possible its natural habitat.

7.4 Major short comings in the programme in Ragunan Zoo concern the lack of technical equipment and finance.

8.0 RECOMMENDATION

As far as Indonesia is concerned, the most important aspect would be the transfer of technology so that the local personnel would be able to handle the entire operation successfully. It is hoped that the British partners would appreciate the need for this technological know-how to be transferred to the Indonesians and would therefore help develop the infrastructure and build up an efficient captive breeding centre in Indonesia.

9.0 REFERENCES

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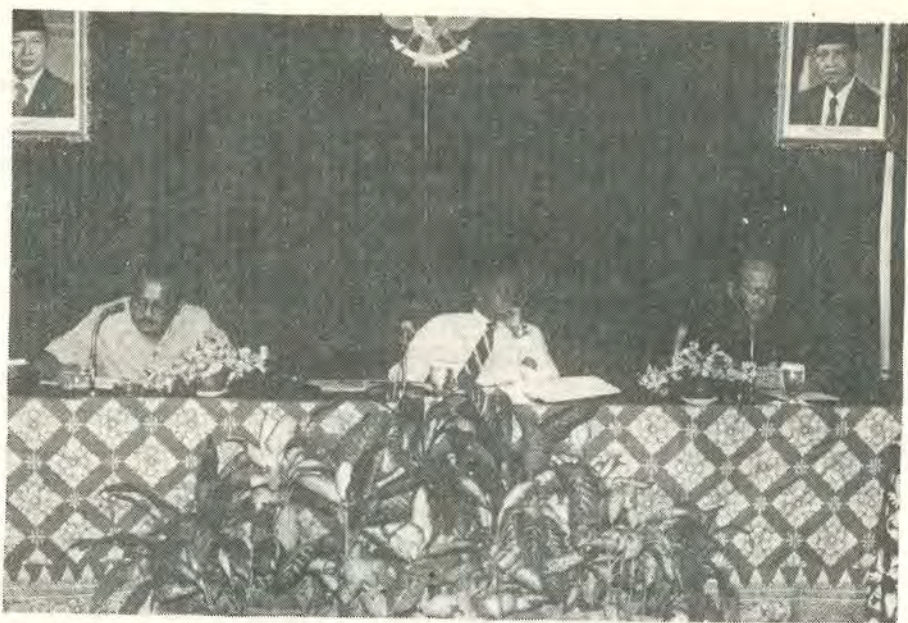
DISCUSSION

SANTIAPILLAI : wanted to know if it was wise to expand oil palm plantations in Sumatra at the expense of wildlife at a time when the world market for palm oil had become glutted ?

MANAN : appreciated the problem and pointed out that as far as Torgamba was concerned, it had already been designated as a conversion forest and so it would be put to other uses than wildlife conservation in any case. Regarding palm oil, he was optimistic that the current downward trend in world market price would be halted and that the demand would once again increase in the future.

Dr. Rubini Atmawidjaja, Director General of Forest Protection and Nature Conservation, Ministry of Forestry, delivering his Closing Address at the Meeting.

A young male Sumatran rhino (Dicerorhinus sumatrensis) at the Torgamba base camp, Riau, Sumatra.

ON THE STATUS OF THE SUMATRAN RHINO IN CAPTIVITY IN THAILAND

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Editors' summary

Dr. Chira Meckvichai, who is the Director of the Dusit Zoo in Thailand received the female Sumatran rhino that was presented to the King of Thailand by the King of Malaysia, to be reared in the Zoo. It was named "Linchong" (means flower in Thai) by the Queen of Thailand. It was very tame and inhabited an enclosure 20 x 35 m where provision was made for the animal to wallow. The animal was seen defaecating often into the water. The food given to the animal was different to what it used to get in Malaysia. Dr. Meckvichai pointed out the difficulties in obtaining wild plants in such an urban city as Bangkok, far from forests. Therefore, as an alternative, the animal was given beans, bananas, sweet potatoes and plenty of leaves. The animal was wormed regularly and it continued to remain healthy. Dr. Meckvichai expressed his concern over the fact that the animal was being given too much carbohydrate at the expense of fibrous material. The Zoo had two post-graduate students to monitor the daily activities of the animal. The Zoo was anxious to obtain a male to begin the breeding programme. If a mate became available, the Zoo authorities were planning to release the pair into a fenced off area in the Kao Yai National Park (where the last rhino was shot 15 years ago). According to Dr. Meckvichai, there were other possible areas (eg Phu Kheo along the Laos border, and Huay Kha Khaeng along the Burma border) where rhinos could be reared in a semi-natural environtment.

DISCUSIION

SANTIAPILLAI : welcomed the idea of breeding rhino in large enclosures in natural habitats and hoped that the experiment would succeed.

MECKVICHAI : pointed out that the animals would be kept in a kind

of "open zoo". He also made reference to the already successful re-introduction programmes on deer that had been going on in Thailand for the past ten years. The question was how successful these captive-bred animals would be in the wild after they were re-introduced. Could they defend themselves successfully against their predators (and poachers) ?

FOOSE : wanted to know if the animals would be released into reserves to roam free or would they be kept in these reserves within large enclosures ?

MECKVICHAI : reiterated his earlier comment that the animals would not be simply realeased into the reserves, rather, they would be kept in large enclosures there. Each enclosure would be about 5 - 10 acres in area and would hold a pair.

PREPARATION TO BREED THE SUMATRAN RHINOCEROS IN ENGLAND

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1.0 INTRODUCTION

There are five species of rhino extant in the world today. They are :

1. Black rhinoceros *(Diceros bicornis)*
2. White rhinoceros *(Ceratotherium simum)*
3. Indian rhinoceros *(Rhinoceros unicornis)*
4. Javan rhinoceros *(Rhinoceros sondaicus)*
5. Sumatran rhinoceros *(Dicerorhinus sumatrensis)*

1 & 2 are confined to Africa, while 3, 4 & 5 are found in Asia (Groves 1967).

Breeding in captivity of the two African species and the Indian rhino is a relatively recent achievement, consequently, very little information is available as a guide to breeding the animals (Bucchner & Mackler 1978). Until 1959, there were 55 Sumatran rhinos in captivity (Groves & Kurt 1972) but no birth was recorded.

''Torgamba'' is the name given to the Sumatran rhino that was caught in Torgamba production forest in Riau province, Sumatra on February 1986. After a long journey lasting six days, it arrived in England in April 1986.

2.0 PRELIMINARY ARRANGEMENTS

Asian rhinos have always been successfully kept in captivity. Even in relatively poor cages, they live for many years (Groves 1982). ''Torgamba'' is kept in an enclosure in the open (20 x 15 m) surrounded by cylindrical iron fence, with access to four stalls (15 x 4 m, 6 x 3 m, 4 x 2 m, and 4 x 2 m). Bathing pools are available in the two largest stalls (4 x 2.5 m and 3 x 2 m). The temperature inside these stalls is about 20 C. The floor of the enclosure and stalls were covered with wood shavings to prevent injury to

the feet. A part of the open enclosure was covered with sand, while two trees were planted to simulate its natural habitat !

3.0 ADVANCED PREPARATION

Close to Port Lympne Zoo Park, about 3 ha of grass paddocks and woodland at a height of 500 m above sea level on a hill was prepared to accommodate two pairs of Sumatran rhinos. It was felt that the Asian rhinos might be affected in unexpected ways in captivity (Groves 1982). It become evident that more attention ought to be given to how best to simulate the animal's natural habitat in captivity. The size of the enclosure must be large enough to allow for movement and exercise, which seem necessary for a successful breeding. If this is done, perhaps Sumatran rhino will have a brigh future, after all !

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DISCUSSION

WIDODO : commenting on Dr. Buntaran's observation that the male Sumatran rhino 'cares for the family' pointed out that it was indeed strange that an animal that seldom lives in a family unit (as it is basically a solitary animal) should 'care for the family'? He also made a reference to the fact that pre-oestrus fighting was known to cause injury in the case of the Great Indian rhinoceros and so wanted to know if a similar phenomenon occurred in the case of the Sumatran rhino as well? If it did, then it would be essential to determine the onset of the oestrus.

BUNTARAN : pointed out that most of the information available came from studies carried out on the African and Indian rhinos. Such information, she added, as far as the Sumatran rhino was concerned, was likely to come from studies that were being carried out in the Howletts and Port Lympne Zoo Park and in the Ragunan Zoo in Jakarta.

RUBINI : noted that artificial insemination had been successfully carried out in cattle and wanted to know if such a technique could in fact be applied in the case of the rhinos too ?

BUNTARAN : replied that in theory artificial insemination ought to be applicable in the case of the rhino too. However she added that the technique was complex and therefore required expertise and expensive equipment.

RHINO BREEDING IN MALAYSIA

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&
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1.0 INTRODUCTION

Presently a Sumatran rhino captive breeding programme is likely to be the only way to save the species from extinction and to increase its population. Rhinos bred in captivity can be released into the wild where their habitat is properly protected.

2.0 THE MALAYSIAN CAPTIVE BREEDING PROGRAMME

Two sites have been identified for the captive propagation of the Sumatran rhino :
(a) Malacca Zoo
(b) Sungai Dusun Wildlife Reserve

There are four sexually mature female rhinos at the Malacca Zoo. A new rhino enclosure has been built here to house the animals. Probably four breeding pairs can be held in the area in the near future. In the Fifth Malaysian Plan 1986 - 1990 (FMP), about M$ 4.82 million will be allocated for zoo development. Part of the funds could be allocated to upgrade the present facility. Grants should also be requested for a long-term captive study and to develop clinical methods especially on test tube rhino (sic), embryo transfer, artificial insemination, and genetics.

A Sungai Dusun Reserve, part of the 10,000 acre reserve will be fenced off for captive breeding of rhinos in a semi-wild condition. Under the Fifth Malaysian Plan (FMP), a total of M$ 1.11 million will be allocated to improve the facilities and for setting up of electric fencing. The area could be compartmentalised for rotational use by a few breeding groups.

3.0 AFFILIATION WITH OTHER ZOOS

The zoos in Jakarta, Kent and Bangkok have Sumatran rhino in captivity. The Malacca Zoo could enter into cooperative programme with these zoos to acquire or loan rhinos on a short-term basis. The DWNP and the Indonesian PHPA are at present interested in the exchange of animals for breeding purposes. Such programmes would benefit the conservation of the rhino and help maintain its genetic diversity.

DISCUSSION

ROEDJAI : was particularly interested in establishing closer coperation between Indonesia and Malaysia so that common reserves could then be jointly maintained and protected. He urged for a greater emphasis on the collaborative training programmes and closer cooperation in scientific research between the two countries.

THE CONSERVATION OF THE JAVAN RHINOCEROS
(Rhinoceros sondaicus Desm.)
A PROPOSAL

FRANCESCO NARDELLI
Studbook keeper of the Sumatran rhinoceros
Howletts and Port Lympne Zoo Park
Hythe-Kent, England

I would like to preface this paper with mention of my deep respect for the work of Prof. Dr. Rudolf Schenkel of Switzerland, and of his wife Dr. L. Schenkel on the Javan Rhinoceros, as well as the Sumatran Rhinoceros, dating back at least to 1967. Without Prof. Schenkel's work on these species, also largely thanks to WWF funding, we would hardly be aware of the problems I intend to discuss today. I must also acknowledge a debt to Mr. Hartmann Ammann of Basel University, Switzerland for his recently published and invaluable doctoral thesis on the Javan rhino.

As both these experts' studies have clearly revealed, the situation for the Javan rhino today is even more serious than it is for the Sumatran rhino: there is only one remaining viable population, of 40 - 60 individuals, concentrated in the 30,000 ha (about 300 - 400 km2) Ujung Kulon National Park (Fig. 2) in Java, Indonesia. The Javan rhino therefore has the dubious claim to fame of being probably the rarest mammal on Earth. And as you know, as yet there is not a single individual in any zoo in the world today.

A single population concentrated in a single location like this is of course extremely vulnerable: to natural disasters, drought or flood, poaching, demographic instability, inbreeding depression etc. There is also some tentative evidence that the Ujung Kulon area may have reached its maximum carrying capacity for the Javan rhino, with the population levelling out in 1975. The numbers of rhino had actually doubled over the previous 17 years since Prof. Schenkel's successful joint effort with the Indonesian authorities to improve management and squash the poaching that was rampant until the late 1960s. Studies so far have further pointed to evidence that there may have been a relatively recent vegetation change in the area disadvantageous to the rhino in terms of its food plant preferences. Possibly linked with this is the potential competition for resourcers with a burgeoning banteng population within the same area. Should local population pressures lead to

any human instrusion into rhino habitat in the future, the animals are bound to suffer. The Javan rhino's tremendous sensitivity to sustained human instrusions into its own natural habitat has also been undelined in recent studies; such instrusions can disturb vital courtship and mating patterns, for instance.

But nothing has highlighted the potential threat to this last population more dramatically than the death in 1982 of five rhinos. Investigations revealed only that they died suddenly from a still mysterious epidemic and infectious disease apparently resembling anthrax and possibly connected with the intrusion of man's domestic animals into the wild rhino habitat.

Prof. Schenkel has made some excellent recommendations on future management aimed at avoiding a recurrence of this tragedy. In summary, these are :

careful monitoring and censussing of the rhino both during the dry and wet seasons

drafting of a detailed vegetation map of the area paying special attention to the rhino's foodplants

deliberate vegetation management so as to encourage growth of the rhino's preferred foodplant environment - open unshaded areas with saplings and bushes etc. This would mean the cutting back of certain palms etc.

control of the banteng population, only if further studies prove the animal is in competition with the rhino

translocation of about 10 rhino to a second location, perhaps in southern Sumatra, to start a second viable population. This is only to be embarked upon when the Ujung Kulon population has recovered from the effects of the 1982 disease and begun to reproduce again.

The new site to be selected with maximum care, bearing in mind foodplant availability, fresh water, clay soil wallows, salt licks, existence of predators and other species now unfamiliar to the rhino, such as tigers and elephants, the ease with which the new site can be patrolled and protected, the attitude of the people living in or near the area.

Another major factor to be tackled, in Prof. Schenkel's view was working conditions for the Indonesian rangers and guards assigned to protect the rhino. He felt they needed field allowances to enhance their salaries, better clothing and equipment, better medical care and better training, for example on how to collect blood and tissue samples during any emergency like the 1982 epidemic.

I heartily concur with Prof. Schenkel's diagnosis and prescription in all except one important respect: he emphasised translocation before any attempt at captive breeding, and indeed was generally opposed to captive breeding, partly because of the fragility of the species and partly because he felt the primary need was simultaneously to conserve the rhino and its natural habitat. I suggest that the situation is too critical to wait, that

capture and captive breeding should commence as soon as feasible, applying the lessons already learned in the current Sumatran Rhinoceros Capture Operation.

This does not mean that Prof. Schenkel's proposals should not be implemented at Ujung Kulon - indeed they should. But the capture operation should be accorded urgent priority. My views on the virtues of captive breeding as against natural gene-pool arrangements and the like are laid out in my accompanying paper on the Sumatran rhino operation: Captive breeding is far safer than natural gene-pool arrangements etc, from the point of view of monitoring disease, poaching and territorial competition, amongst other likely problems. Captive breeding also allows closer observation so that valuable data on the animals' habits can be gathered for application to better management of populations still in the wild.

Translocation is too risky and difficult a venture, as well as costly — funding might prove a problem. However, it could be integrated into a conservation project as a second stage to follow only after a captive nucleus has been safely established and funds made available to local agencies in Indonesia. As with the Sumatran rhino operation, transfer of both technology and funds to the host country, Indonesia, would be an integral part of the conservation plan.

I propose therefore that an operation to capture some Javan rhino for captive breeding be instituted as soon as possible. I suggest that the capture operation be concentrated along the eastern fringes of the Ujung Kulon National Park, where poachers and disease are a more likely threat to the animals, thus leaving the core area's population as undisturbed as possible. Experience with the Sumatran rhino operation so far should have given us the confidence and courage to proceed with this venture, which I now consider to be of the highest importance to the survival of the species.

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PLAN FOR CAPTURE OPERATION

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In order to determine more accurately the sex ratio, age and number of the rhino population, we should survey the whole area and in particular the eastern fringes. Surveys based on the track dimension, shape, especially with plaster casts, are realiable but time consuming. Furthermore we have already an accurate report by Dr. Hartmann Ammann. In this case, I recommend the use of remote controlled cameras. 20 - 30 of the 35 mm still cameras could be purchased cheaply or even supplied free (in exchange of publicity) by a big company. These cameras, with a flash incorporated, should be placed on rhino trails, in several places in Ujung Kulon. Indonesia based,professional photographer, Mr. Alain Compost has already confirmed that he is available to set up the cameras and indeed he has already got pictures of lepoard, tiger etc. using this method. A couple of rangers can check the cameras every few days. The whole operation will require only a few months and will not disturb the rhinos.

The base camp as well as the holding pens for the captured rhinos should be set up along the eastern fringes of the park.

The use of pit traps instead of stockade types is highly recommended as negative experience has indicated during the capture operations in 1960 and in 1986 (Torgamba). Professional animal collector Mr. Tony Parkinson is the best person to carry on with the capture and he will give the best advice on this matter.

The use of local trees for the construction of the holding pens and traps should be avoided for obvious reasons, but it may prove to be too expensive and impractical to carry the necessary poles from outside the Park.

As with the Sumatran rhino, a long period of acclimatization (at least two months) should follow after the capture of the rhino, before transporting it to the zoos.

DISCUSSION

SUKIANTO : indicated that Pulau (island) Panaitan could be considered a second home for the Javan rhino. However, he cautioned that capture

operations would prove to be difficult, especially along the eastern part of Ujung Kulon peninsula since the terrain there was swampy.

RUBINI : concurred with Sukianto's comment and accepted the proposal of translocation some rhinos from Ujung Kulon to the Pulau Panaitan as a valid option.

WIDODO : pointed out that the number of rhino in Ujung Kulon doubled between 1969 and 1979, largely due to the efforts of Dr. Schenkel and his wife and the dedication of the guards. He recommended extreme caution before any effort was made to capture the rhinos in Ujung Kulon for breeding in captivity. He added that it was necessary to postpone such an operation until there was clear evidence that the carrying capacity of the reserve had been reached. At present, according to him, there was no firm evidence that this was indeed the case. The census showed that the numbers seemed to be constant. He therefore urged that we wait until the saturation point was reached.

NARDELLI : argued that if the numbers had in fact remained constant, then the saturation point had already been reached !

WIDODO : referred to the fact that there were no positive signs that the numbers had in fact reached the carrying capacity. Since the Javan rhino, by nature being a wanderer, he argued that should the numbers reach the carrying capacity, there would have been at least some signs of animals leaving the core area and moving out. In 1967, there had been such signs that animals did indeed move out. He therefore urged that more studies be undertaken to settle this issue. Only 40% of Ujung Kulon is under primary forest cover. The best habitat for the rhino is along the southern part of the park, where until now the secondary vegetation had increased the carrying capacity. He therefore doubted whether a serious change in the habitat quality had in fact occurred in Ujung Kulon ?

NARDELLI : referred to Dr. Schenkel's studies and pointed out that they revealed that there had indeed been some changes in the food supply of the rhinos.

WIDODO : argued that such information came from the study of vegetation plots in the park. Plots that were established near the permanent rhino habitats were found to be utilized by the animals, while those that were set up 1000 m away from these habitats were not used. He also referred to the fact that there was no lack of food plants for the rhinos, which are known to eat more than 100 species of plants, to overcome temporary fluctuations in the availability of any one type of species. The animals were known to shift their feeding activities from one area to another and so he doubted if the habitat in Ujung Kulon was indeed a limiting factor for the rhinos at present.

RODJAI ; agreed with Mr. Widodo's observations. He pointed out that disease was a possible cause of the sudden mortality of some rhinos in Ujung Kulon. He referred to the demise of the banteng in Pangandaran Nature Reserve (Java) as a result of the eruption in 1982 of the volcano, Gunung

Galunggung. He added that the more important issue was the successful breeding of the animals in the wild rather than in captivity, and recommended a cautions approach towards the captive breeding programme. He was in favour of breeding the rhinos in their natural habitats to that in captivity.

COUNTRY REPORT — INDONESIA

Rhino Management in Indonesia

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1. INTRODUCTION

1. Background

In Indonesia rhinos are only distributed in Java and Sumatra. Javan Rhino *(Rhinoceros sondaicus)* was recorded almost throughout Java in the 18th century. Sumatran Rhino *(Dicerorhinus sumatrensis)* was known widely distributed from Aceh in the north to Lampung in the south of Sumatra previously. The existence of a belief that certain parts of the animal particularly its horn for drug, caused tremendous demands and soaring prices on them. During that period it is said that the population of Javan Rhino was quite high and at times even a nuissance in some areas. This was followed by period of extensive hunting. The decrease of their habitats and such hunting have reduced the population of Javan Rhino to about 53 in the Ujung Kulon National Park. Similar situation too, affecting its population in such a way as to make its distribution discountinuous. Both species are already legally protected, but poaching still continues and presents a threat to their continued survival.

1.2 Problems

There are several points which could be discussed concerning the fate of the two rhino species in Indonesia :

1.2.1 Javan and Sumatran Rhinos face quite a serious threat particularly from poaching. People still believe that rhino horn has certain magical medicinal values. The news of their poaching in Ujung Kulon and Sumatra can still be heard, now and then.

1.2.2 The outbreak of a mysterious disease in 1981 killed 5 individuals of the Javan Rhino. The exact cause of their death is not known. It could be anthrax. On the other hand it is suspected that a change in the habitat

might have played a role.

1.2.3 The reduction of its habitat is suspected to be one of the main causes for the decrease of the population. The decrease in amount and distribution of certain edible plants in Ujung Kulon is also suspected to be a cause of the death. The ongoing logging and the conversion of forest to other uses reduce the habitat of the Sumatran Rhino, and thereby alter the ecosystem of the rhino.

2.0 THE SITUATION OF RHINO POPULATION IN INDONESIA

2.1 Javan Rhino *(Rhinoceros sondaicus)*

2.1.1 Classification

The animal is single horned, solitary or lives in small groups of two (male and female) or three (male, female and young). It is very sensitive, that is why an undisturbed forest that can supply the necessities of life is obligatory. Javan rhino's diet includes an overabundance of leaves.

2.1.2 Habitat

Javan rhino is found only in the Ujung Kulon National Park where it occupies restricted areas especially lowland and swamps up to 1000 m above sea level. It prefers shade and bush and avoids open areas. It likes to wallow. It seems that there have been very significant changes in the composition of forest trees in its habitat in Ujung Kulon, especially in its preferred food plants.

2.1.3 Population

The number of the Javan Rhino seems to fluctuate. The 1981 census figure is quite encouraging, though in 1982 there was an outbreak of an unknown disease which killed 5 animals.

The figures of their population size based on the data collected by Hoogerwerf (1970) and by the Ujung Kulon National Park Officers (1983) are as follows :

1937	25	Individuals
1955	30 — 35	individuals
1967	21 — 28	individuals
1975	45 — 54	individuals
1981	58	individuals
1982	52 — 53	individuals

The main threats to the population are poaching and diseases but the current management practice and the antipoaching measures taken so far show significant improvement on the rhino population.

2.1.4 Problems

Several problems closely related to the survival of the Javan Rhino Population in Ujung Kulon still remain. These are :

Habitat : The uneven distribution of the preferred plants of the rhino. It is suggested that in some restricted areas measures should be taken to increase the productivity of the habitat.

Facility : The lack of facilities for more efficient management is still the major constraint.

Guarding : Counter measures toward poaching and other disturbances should be intensified throughout the park.

Expertise : Specialists on rhino are needed to study all aspects of the rhino ecology and to monitor the fluctuation in number more accurately.

2.2 Sumatran Rhino *(Dicerorhinus sumatrensis)*

2.2.1 Classification

This is the smallest living species of rhino. Its skin is hairly like that of a buffalo, that is why the animal is also called wooly rhino. It has two horns, lives solitarily or occurs in small groups of two i.e. female and young. Active in the night (nocturnal).

2.2.2 Habitat

The species is found almost all over Sumatra but particularly in Aceh, Riau (along Siak River), West Sumatra, South Sumatra and Lampung. Unconfirmed information indicates that the species may also be found in East Kalimantan. In the Gunung Leuser National Park its habitats are only restricted to the primary forests between 1000 — 1900 m above sea level.

2.2.3 Population

Marcus Borner (1979) informed that there were about 40 animals in the Gunung Leuser National Park. The animals only live in the relatively moist areas. There are about 20 animals in the Kerinci Seblat National Park area in Jambi : in the Gunung Tuju forest and some are found along the Seblat River in Bengkulu. Several small groups were also found in Langkat area (North Sumatra Province), Trogamba area (between North Sumatra and Riau Province) and Berbak Game Reserve in Jambi.

2.2.4 Problems

The decrease in the rhino population is due to poaching carried out in order to collect the horn for medicinal purpose, as well as a

reduction of its habitats which are being converted to other land uses. Poachers catch and kill the animals using special traps with spears which can stab the animal in the back.

3.0 MANAGEMENT

3.1 Legal Protection Measures

Both species of Sumatran and Javan rhino are already protected under the Ordinance on the Wildlife Protection 1931 Np. 134 and No. 266, which *inter alia* state that "it is prohibited for hunting, capturing, killing and possessing any live or dead specimen or its parts and derivatives."

The appointed leading agency for enforcing the act is the Department of Forestry c.q. Directorate General of Forest Protection and Nature Conservation.

3.2 Cooperation for Rhino Conservation

In view of the drastic decline of the rhino populations, the Indonesian Government c.q. Directorate General of Forest Protection and Nature Conservation took a number of measures in order to protect them and even to enhance their populations. The most recent measure taken is the setting up of the Sumatran Rhino breeding programme. The Howlett and Port Lympne Zoo in England is well known for its experience in breeding wild animals in captivity. The first stage will include the capture and breeding of 4 pairs of Sumatran rhino. Two pairs will be kept in England and the other 2 pairs in Indonesia. The ongoing capture operation so far has succeded in capturing five animals in Torgamba area in the Riau Province. The Capture is carried out in a destroyed and doomed rhino habitat which is no longer possible to rehabilitate. The forest area in being converted to oil palm plantations. So far 5 rhinos have been captured, with one death. A pair of rhino has been sent ot the Howlett and Port Lympne Zoo in England, while one young male rhino was sent to the Ragunan Zoo in Jakarta.

4.0 CONCLUSION

4.1 Sumatran Rhino *(Dicerorhinus sumatrensis)* and Javan Rhino *(Rhinoceros sondaicus)* have quite low populations in Indonesia. It is estimated between 450 - 700 Sumatran rhinos and 53 Javan rhinos are present today. By the recent *ex situ* breeding cooperation their future looks more promising.

4.2 The Sumatran rhino conservation cooperation has already established a breeding programme between Directorate General of Forest Protection

and Nature Conservation and Howlett and Port Lympne Zoo, United Kingdom and an exchange of rhinos between Indonesia and Malaysia is planned in the near future.

4.3 The National Park status for Ujung Kulon, Gunung Leuser, Kerinci Seblat and Barisan Selatan Reserves gives more guarantees to ensure the survival of both Javan and Sumatran rhinos.

4.4 A priority for research on the ecology and biology of both Javan and Sumatran rhinos should be initiated.

4.5 There is a need to improve the skills of the field staff to better cope with the ongoing problems, particularly in preventing poaching and in guarding the habitats of rhino in cooperation with local government and police.

COUNTRY REPORT — MALAYSIA
DISTRIBUTION AND POPULATION OF THE SUMATRAN RHINOCEROS *Dicerorhinus sumatrensis* IN PENINSULAR MALAYSIA

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BACKGROUND AND INTRODUCTION

The existence of about two Sumatran rhino in the Endau-Rompin area was mentioned by J.A. Hislop in 1965. The rhino conservation efforts in Peninsular Malaysia began in 1973 when the Department of Wildlife and National Parks drew up plans to study the species on a scientific basis. A graduate officer was obtained for this purpose through the Peace Corps Programme. Practical field studies began in 1974 with the proposed Endau-Rumpin National Park being designated as the primary study area. In 1978, a Malaysian counterpart was recruited who under-studied this officer and subsequently continued the research as well as supervising the management plan that was drawn up. These studies have given us sufficient data on the population size, density, habitat requirements and the general ecology of the Sumatran rhino in the Endau-Rompin area.

At the Ist IUCN/SSC Asian Rhino Specialist Group Meeting held in Bangkok in 1979, an analysis of the situation of the species was considered a priority to be followed by the formulation of action plans to ensure the survival of the Sumatran rhino. The problems faced by the species were to be identified and the proper remedial measures taken in the light of its urgency and priority decided in each case. A strategic plan was to be developed by integrating the information gathered over a period of time.

Viable populations are needed for the long term survival of the Sumatran rhino. These populations have to be rigidly protected and systematically managed to ensure their continued survival. Survival improves with increased reproduction and decreased mortality. The more areas holding these rhinos are identified, the greater will be the rate of survival. There is no substitute for good information on breeding, numbers, home range, carrying

capacity and movement for effectively managing the species. Regular surveys have to be carried out to monitor known populations. The Sumatran rhino lives in forests both in the lowlands as well as the mountains. It feeds on tree saplings, climbers and other forest plants. In Peninsular Malaysia, three hundred species of plants have been identified as food items for the rhino. Surface water, wallows, salt licks and cover are important requisites of the animal. The Sumatran rhino is predominantly solitary in nature and has a large home range. The Sumatran rhino is endangered in Peninsular Malaysia. Fig. 4 shows the localities where the animal is known to be present. Poaching and illegal trade have been brought to a minimum and they do not therefore pose a serious problem. The general public too are in favour of wildlife conservation.

Taman Negara : Since the Ist Meeting a great deal of work has been done to survey the area. Information given elsewhere in the paper (Table 1) indicates that between 22 and 36 rhinos are known to occur in Taman Negara. Taman Negara being a national park, provides a sanctuary for the rhinos. The proposed plan to build a dam on the Tembling river has been shelved indefinitely.

Sungai Dusun Game Reserve : This game reserve has an area of 10,400 acres set aside for the conservation of the Sumatran rhino inhabiting the area. The surrounding areas are extensively developed and therefore pose a serious threat to the integrity of the animals. A lot of work has been done on the species and estimates of the population size vary from 3, 3-5 and 5-6 depending on who carried out the surveys. The capture of rhinos for a captive breeding programme has resulted in 4 females in captivity. One female was killed in 1986, while in 1984 a young male rhino died after it was abandoned by its mother. There should be another 3-4 animals; a female and its young and possibly two males. Past estimates have been rather conservative. Apart from the captive breeding programme to be carried out in the Malacca Zoo, a gene-pool project too is being planned for the Sungai Dusun Game Reserve.

Taman Negara holds the most number of Sumatran rhino in Peninsular Malaysia. On the south western part of the park, along the Sungai Tanum, signs of rhino were observed at Jenut Atai and Jenut Kumbang. The number is estimated between 2-4. Travelling by boat up the Tembling river, the point of entry to the park is at Kuala Atok. Rhino signs are often observed by visitors to the upper reaches of this river. About 3-4 animals are known to occur here. Further up the Tembling river is Kuala Tahan, the head quarters of the National Park. The valley of the Tahan river is the area that is most frequented by both visitors as well as Park staff. On a number of occasions, rhinos had actually been seen by wildlife officers. At least 3-4 animals occur in this valley. Further up the Tembling river, after passing the Trenggan and the Kenyam rivers, is the Sat river. The upper part of this river has a number of tributaries such as the Jintoh, Gagau and Lotong rivers, where rhinos have been observed. Gunung Gagau extends on to the borders of
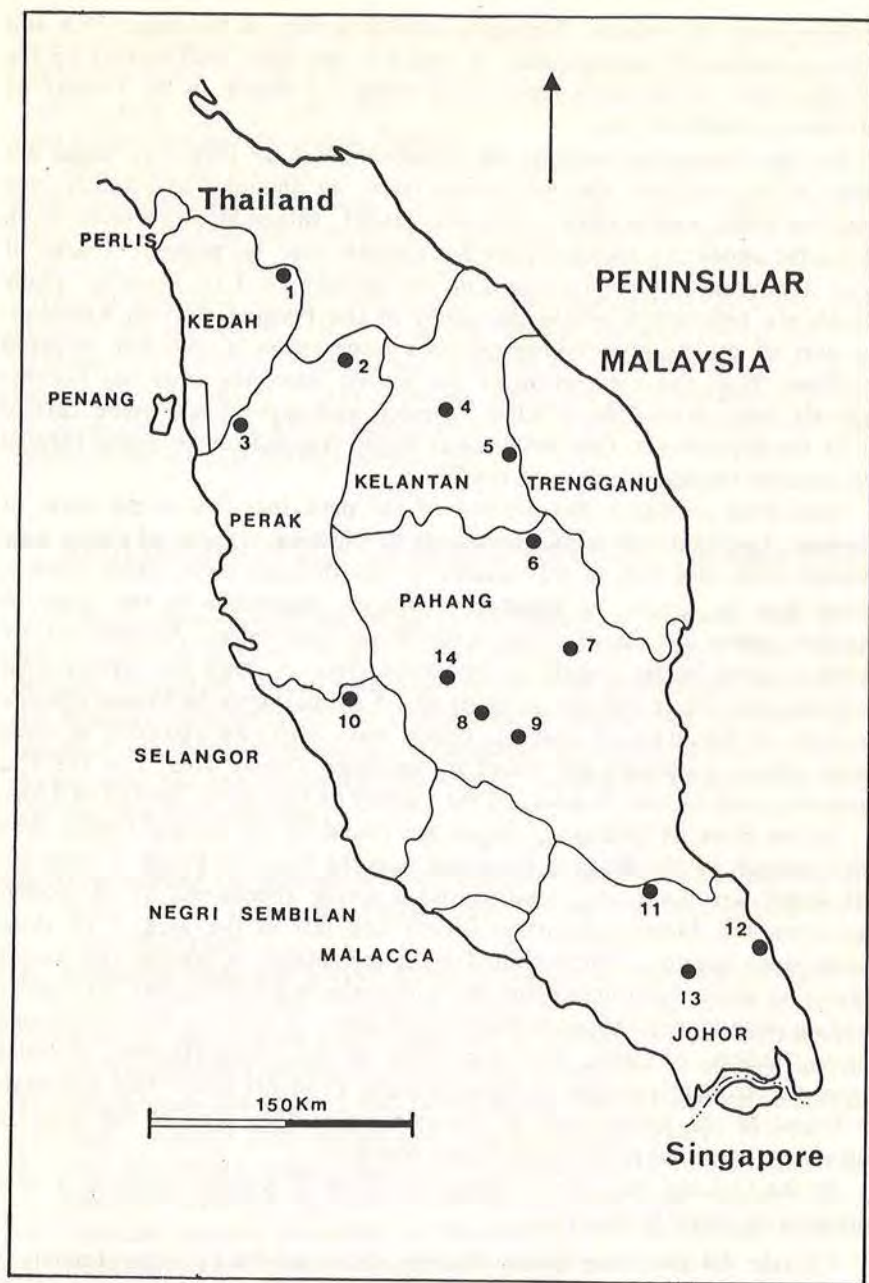
Fig. 4. Map of Peninsular Malaysia showing the locations where the Sumatran rhinoceros is known to be present.. 1. Kedah border, 2. Ulu Belum, 3. Ulu Selama, 4. Kuala Balah, 5. Sungai Depak, 6. Taman Negara, 7. Sungai Lepar, 8. Krau Reserve, 9. Bukit Gebok. 10. Sungai Dusun, 11. Endau-Rompin, 12. Mersin coast, 13. Gunung Belumut, 14. Ulu Atok.

the three states of Pahang, Trengganu and Kelantan. A minimum of 6 and up to as many as 10 animals may be found in this area. Still further up the Tembling river is the Sepia river which holds 2-3 rhinos in the vicinity of its tributary, the Reh river.

On the Trengganu part of the National Park at least two areas are known to have rhinos. On the Cacing river, an animal was actually seen along the bank, and wallows were also found. Information received from old guides appear to indicate that 2-3 animals may be present. Tracks of about 2-4 animals were recorded in the vicinity of Ulu Pertang. These animals are believed to utilize the valley of the Pertang river in Kelantan. The part of the park in Trengganu to a large extent is still not surveyed for rhino. With the completion of the Kenyir dam, the area has become relatively more accessible. Wildlife research and surveys are being carried out by the department. One animal was found trapped on an island formed as a result of the construction of the dam.

Somewhat similar is the portion of the park that lies in the State of Kelantan. Less than ten trips were made to the area. Tracks of rhino were recorded from one area in the vicinity of the Melimau river. More work is needed here to assess the number of rhinos. Elsewhere in the State of Kelantan, about 2-4 rhinos occur in the Balan river valley. Another 2-4 are known to occur in the vicinity of the Depak river. A rhino was sighted near the Yong river where perhaps as many as 3-5 animals may be found. Outside the park, in the State of Pahang, rhinos were seen and recorded at three places: About 2 animals are found in the Bukit Gebok area; 2 in the Ulu Lepur area and another possibly in the vicinity of Ulu Atok, district of Lipis.

In the State of Selangor, rhinos are found in the Sungai Dusun area which extends to the Bernam river and into the State of Perak. 6 animals, 4 of which were captured, 1 killed and a young abandoned by its mother were from this heavily disturbed forests still left in the area. 5 of these animal were females. There should be a few males, a female and young numbering about 3-4 animals that the authorities hope to capture for captive breeding programme. About 6 rhinos are known to occur in the Ulu Selama area of the State of Perak. Two important salt licks, Sira Harimau and Sira Kemia are frequently visited by these animals. Probably more than 2 animals are found in the Belum area at the extreme norther part of the state. 2 animals are recorded in the Bubu Forest Reserve.

In the Gunung Inas forest reserve, in State of Kedah, tracks of 1 or 2 animals were recently recorded.

Outside the proposed Endau-Rompin National Park, approximately 3 rhinos may occur in the Belumuth forest reserve. The vastly cleared forest between Mersing and Kota Tinggi stretching to the sea may hold about 5 or 6 animals. A female was captured at Tenggaruh. Further research was then concentrated on the distribution of the species in the Peninsula. These studies showed that while there were stable and well protected populations in several palces, there were equally some small and fragmented groups or

individual rhinos in high risk areas (or areas that are likely to become high risk owing to the on going land development programmes). It was decided to capture these animals and either translocate them to other safer areas or start a breeding programme in captivity.

This decision brought into focus the fact that dealing with the country's most endangered species and one of the world's rarest large mammals necessitates extreme caution so that the risks were held to a minimum. It also became clear that the Department's own experience in the capture of elephants and gaur in itself was not sufficient enough to undertake such a delicate and important task. It was for this reason that efforts were made to obtain the expertise from abroad, while at the sametime actually initiating the programme locally. It was about this time that the American Association of Zoological Parks and Aquariums (AAZPA) made contact with us to express their interest in the species.

REQUIREMENTS FOR A CAPTIVE BREEDING PROGRAMME

This is something on which we in the Peninsular Malaysia have devoted many hours of anxious thought simply because we realised that while the decision to capture the Sumatran rhino could be made easily enough — as the Wildlife Authority in the Peninsular Malaysia, our opinion and experience would be respected — translating this decision into a successful programme was completely another matter. Among the factors that made us hesitate, are the following :

1. The number of animals that are potential candidates for capture are so few that absolutely no margin must be allowed for learning error or experimentation.
2. Relatively little was known about the animals' response to capture and subsequent captivity. The most recent capture operation in the early seventies in the Riau archipelago was a disaster because the majority of the animals died during the capture, transportation or shortly thereafter.
3. The animals are solitary and so dispersesd that the task of identifying a target animal's range would take a long time and effort.
4. The conditions under which this research and the subsequent capture have to be carried out are perhaps amongst the most difficult for large mammal capture anywhere in the world. This is because of the sheer inaccessibility of most rhino habitats to surface transport.
5. The project was going to require funds for the work of the survey teams, for the construction of traps and transport cages, and for the purchase of suitable vehicles. On the whole, in Peninsular Malaysia, we felt that we could find the necessary funds for these requirements.

ACTIVITIES TO DATE IN THE PENINSULAR MALAYSIA

A) The capture of two female Sumatran rhino in Peninsular Malaysia: In April 1984, a young female Sumatran rhino was captured by estate workers in an oil palm plantation, near Jeram, Selangor. This animal was one of the young born to the Sungai Dusun Group and the Department had been aware of the animal's movements for more than seven months. Apparently, the animal had just reached the age when it had to find a territory on its own. This, it could not do in the Sungai Dusun area, probably because of two reasons :

1. there was already a sizeable population of rhino occupying the somewhat small habitat available for them at Sungai Dusun and its surrounding forest, and
2. recent land clearing and development had further reduced the amount of forest available in the general area.

The animal had taken to wandering into the maze of oil palm plantations south of Sungai Dusun and at the time of its capture, it was in fact very much at home in such a habitat. This is in marked contrast to the behaviour of rhinos in the forest which need a closed canopy forest.

The second animal caught was also similarly young and was apparently trying to locate a territory. She too was probably from the general Sungai Dusun group of animals not unlike Jeram (the name of the first animal) had probably lived north of the Bernam river and had wandered into plantations adjacent to the rapidly developing Melintang forests.

We consider ourselves extremely fortunate in having brought both animals into captivity without any major mishap. In both cases, suitable transport cages were available and the point at which the estate workers had seccured the animals was accessible to both lorry and crane. This allowed us to have both animals crated within 24h of capture and transported to the Malacca Zoo within the subsequent 12h. However the whole operation was carried out under emergency conditions and anything could have gone wrong. Certainly we would not even dream of carrying out any capture operation if we did not have infinitely more control of our circumstances.

B) The current capture operation: There are at present two areas in the Peninsular Malaysia where the Sumatran rhinos are surviving in isolation and in some degree of risk. These areas are: Bukit Gebok in Pahang, and Tenggaroh in Johor. Both areas have possibly two animals each. The department constructed a corral-type trap in each area and is in the process of establishing a number of pit traps at both sites. The corral-type was abandoned as it was found unsuitable.

On the 8th February 1986, an adult female was captured in our pit trap in Tenggaroh. We mounted an operation to take the animal (a

female) out and by evening, of the following day the animal was successfully taken out of the pit and transferred to the Malacca Zoo. She was in excellent condition. On the 6th July 1986, another female, believed to be from the Sungai Dusun population, was captured near Sungai Samak, Ulu Bernam, Perak. She too was successfully retrieved from the pit the same night and transferred to the Malacca Zoo. The latest rhino capture was on the night of 8th September 1986, when an animal was caught in a pit trap near Sungai Dusun.

Table 1. Distribution of Sumatran rhinoceros in Peninsular Malaysia.

State	Locality	Minimum	Maximum
Pahang	TAMAN NEGARA		
	Tanum	2	4
	Atok	3	4
	Tahan valley	3	4
	Gagau	6	10
	Sepia	2	3
	Cacing	2	3
	Ulu Pertang	2	4
	Ulu Merlimau	2	4
		22	36
Kelantan	Kuala Belah	2	4
	Sungai Depak	2	4
	Sungai Yong	3	5
		7	13
Pahang	Krau	1	1
	Bukit Gebok	2	2
	Ulu Lepar	2	2
	Ulu Atok	1	1
		6	6
Selangor	Sungai Dusun	3	4
Perak	Ulu Selama	6	7
	Belum	2	4
	Bubu Forest	2	2
		10	13
Kedah		1	2
Johor	Endau-Rompin	10	25
	Gg. Belumut	3	4
	Mersing/Kota Tinggi	5	6
		18	35
Total		67	109

DISCUSSION

SINGHAPANT : commenting on the situation across the Thai/ Malaysia border, pointed out that such a proposal was discussed by the Wildlife Committee in Bangkok and had been accepted. Currently efforts are being made in Thailand to designate the area a Wildlife Sanctuary.

KHAN : mentioned that similar efforts were also being made in Malaysia. In reply to a query from Mr. Nardelli, he said that some fighting was observed between two female rhinos when they were first brought into contact in captivity. Asked by Prof. Rubini if the male or the female was the more aggressive, he replied that he could not comment since there were no male rhinos in captivity in Malaysia !

BLOUCH : pointed out that in Sumatra the only lowland area in which the rhino occurs was the Torgamba production forest, the rest of the animals being confined to the hills. He asked whether this was the case in Malaysia too ?

KHAN : replied that the animals in general inhabited the hills in Malaysia, but some animals were also found in lowland areas such as Sungai Dusun.

WIDODO : wanted to know why in Indonesia, more male rhinos were being captured, while in Malaysia only females were getting caught ?

ABDULLAH : felt that Dr. Buntaran's explanation that the males were more alert than the females might not be the reason for the disproportionate sex ratio of the animals in captivity. He argued that the explanation might be found in the home ranges: the males tended to have a larger home range than the females and therefore the females were more likely to get caught in traps than the males.

SANTIAPILLAI : asked in that case why it should not be so in Sumatra as well ?

KHAN : responding to Ir. Roedjai's comment said that the ultimate target in Indonesia was to set aside 10% of the total land area for Nature Conservation, but added that land acquisition was a more difficult problem in the Peninsular Malaysia where the pressures from the human population were high. Nevertheless, Mr. Khan said that between 8 - 10% of the land is to be set aside for Nature Conservation in Malaysia. He also referred to his continuing efforts to increase the conservation areas through a compromise with the Forestry Department in such a way that forests could be used for dual purposes: forestry and wildlife conservation. There were good indications for future progress in this field.

DRAFTING OF RECOMMENDATIONS

Mr. MOHD. KHAN BIN MOMIN KHAN
Chairman
IUCN/SSC Asian Rhino Specialist Group

Editors summary

Mr. Khan started reviewing the progress made so far in the field of Rhino conservation. There is currently more information available on the status of the rhino in India than in Malaysia. Nevertheless, the Great one-horned Indian rhinoceros must also be included in the discussions. Mr. Khan preferred the use of the word 'recommendation' to 'resolution' as it was less controversial. Three meetings were held up to now (Thailand, Malaysia & Singapore). Since then, substantial progress had been made but much still remains to be done. The Indian rhino seems to be doing well in India and Nepal as a result of efficient management and effective protective measures. Nevertheless, poaching still remains a problem. On the other hand, serious problems are faced by the Javan and Sumatran rhinos, which are listed as being endangered in the IUCN Red Data Book. He then went on to outline the steps that need to be taken in the future :

1. Mr. Khan reiterated the need to prepare Action Plans for the three species of rhino in Asia to consider both their *in situ* as well as *ex situ* conservation.
2. Establishment of reserves in areas where the rhinos currently occur is essential. However, it is not often easy to appropriate land for wildlife conservation in the face of growing human population and its aspirations. It would therefore be naive to expect the Government to set aside enormous areas solely for the purpose of wildlife conservation. But every effort must be taken to set aside as much as possible while there is still time and land. Serious consideration must be given to the possibility of making multi-purpose reserves to accommodate both forestry and wildlife conservation. In Peninsular Malaysia, once the Government allows the Wildlife Conservation Department to take charge of an area of forest, then the responsibility for managing that area falls on the Department itself and so no other land-use (e.g: logging) can ever be practised. This is the reason why the Government more often than not is very reluctant to allocate large areas of forest land to Wildlife Conservation!

3. Due consideration must be given to the captive breeding programme and appropriate recommendations should be made at this forum. Initial setbacks should not deter our committment. e.g: In Malaysia there had been considerable opposition to the establishment of a captive breeding programme in Sabah. On the otherhand, substantial progress had been made in this field in Indonesia through a collaborative programme with the Howletts and Port Lympne Zoo Park (UK). So far, five animals had been captured in Sumatra and in Peninsular Malaysia, five more had been caught. Plans are afoot for the capture of more rhinos that are ''doomed''. It is hoped that in time there would be sufficient number of rhinos in captivity for breeding them in zoos in Indonesia, Malaysia, England and America. The Chairman recommended that the Singapore Proposals be endorsed at this meeting with some modifications.

MANAN : pointed out that like in Malaysia, there were considerable problems in Indonesia too for wildlife conservation. Fortunately however, there was still more land available in Sumatra than in Peninsular Malaysia to set aside for conservation. Already Sumatra has a number of large National Parks such as the Gunung Leuser, Kerinci-Seblat, Barisan Selatan etc. where the Sumatran rhino occurs. But what was needed were efficient management and effective anti-poaching measures in Sumatra. He also referred to the importance of establishing buffer zones around the reserves and national parks. On the matter of captive breeding, he made a special mention of the successful tie-up beteen Indonesia and the Howletts Zoo, but added that a good follow up was needed especially in the field of staff training, transfer of technology and know-how. He hoped that International organizations such as IUCN and WWF too would extend their help and assistance. There was a need to calrify the status of the rhino in Kalimantan and so he urged that more surveys be carried out there. He then addressed the important aspect of what constitutes a ''doomed'' population. He asked for an exact definition of what a ''doomed'' population was? Torgamba, has already been allocated for conversion to oil-palm plantations and so the removal of the rhinos from this forest was both necessary and justified.

ANDAU : pointed out that in the State of Sabah, there had been much progress made so far in habitat protection. Wildlife reserves were legally gazetted. The most serious problems were those concerning the extension of wildlife reserves, and increasing the manpower resources which were essential to carry out ground surveys and combat poaching. He recommended that further surveys be carried out jointly by Malaysians and Indonesians to assess the situation of the rhino across the Sabah/Kalimantan border.

SINGHAPANT : mentioned that very little was known about the rhino in Thailand. He added that it was unlikely that the animal still survives in Thailand. Nevererthleless, he recommended that surveys be carried out especially along the western and southern borders of the country where, if at all, some rhinos were likely to wander in from Burma or Malaysia. There were definite plans to set up trans-border reserves between Thailand, Burma

and Malaysia. He expressed the hope that a male rhino could be obtained to start the captive breeding programme in Thailand, in view of the fact that there were already nine animals in captivity.

FOOSE : handed out copies of the Singapore proposals for consideration and endorsement, subject to any modifications recommended by the House. He suggested that each of the species of rhino be considered separately, and in the case of the Javan rhino, he hoped that there would be some recommendations on what actions that need to be taken. The Singapore proposals provided a good framework. He then referred to the item 3 in the proposals, as one that needed modification. The situation, he added had changed since 1984, when the proposals were drafted; therefore, instead of having a paid "coordinator", the "development and oversight of the Master Plan will be the responsibility of the SSC/ARSG". Dr. Foose suggested that this statement would replace the item 3. He added that ARSG could appoint a sub committee to discuss this matter.

WIDODO : agreed with Dr. Foose that ARSG could take care of the job rather than a "paid coordinator". He also made reference to his earlier comments on the Javan rhino and urged that more attention be given to studying such aspects as changes (if any) in the number of rhino over time, habitat condition, carrying capacity of Ujung Kulon itself etc. While the Singapore proposals were comprehensive and useful, Mr. Widodo was concerned how they could be effectively implemented.

MANAN : agreed that item 3 in the Singapore proposals ought to be modified. He added that the implementation of the proposals was based on a bilateral agreement between Howletts & Port Lympne Zoo Park and Indonesia.

RUBINI : looked back to the time when Indonesia was developing a cooperative agreement with the Howletts & Port Lympne Zoo Park (HPLZP). At that time the proposals were drafted to determine what should be done (or what should not be done!) about the breeding of Sumatran rhino in captivity. He added, "For reasons of practicality, the agreement was made between Indonesia and HPLZP in such a way that the two parties should be seen clearly to be in the programme". He further added, "the involvement of the IUCN in this respect is implied in this agreement and therefore it is redundant to mention IUCN in all the clauses". It was therefore understood that IUCN was involved and so he suggested that the item 3 should be "streamlined".

KHAN : suggested that the item 3 should be changed in the Singapore proposals to read, "Development and oversight of the Masterplan will be the responsibility of the SSC/Asian Rhino Specialist Group". The rest must be deleted.

The House endorsed this change.

FOOSE : referred to item 5 (f) in the Singapore proposals and suggested likewise that it be modified to replace "coordinator and advisory groups" with "SSC/ARSG".

RUBINI : wanted the priorities in item 4 altered: 4 (a) should be given a lower priority than 4 (b). Therefore in the revised proposals, 4 (a) = old 4 (b); and 4 (b) = 4 (a).

MECKVICHAI : referred to item 5 (e) in the Singapore proposals and requested that Thailand be mentioned as a country of origin for the rhino.

FOOSE: suggested that the phrase, "among others, Indonesia, Malaysia and Thailand" be inserted in item 5 (e) following "countries of origin".

RUBINI : took up the question of "doomed" rhinos. He wanted to know who would decide (and on what basis) that a population of rhino is "doomed" ?

KHAN : saw no problems on this matter since it was up to the Wildlife Department to decide what animals were "doomed". For example, he took the case of Sungai Dusun: it is 10,400 acres in extent, but surrounded by huge oil palm plantations, towns and roads etc. Rhinos are known to wander in and out of oil palm plantations and rice fields. Therefore a decision was made by the Department of Wildlife and National Parks to capture these animals on the basis of an assessment of the situation then made. 4 animals were caught and more remain to be captured in this area where the animals are doomed. He also mentioned that logged over forest was not a bad habitat for rhino.

NARDELLI : stressed the importance of determining what the "doomed" populations are, at this meeting.

FOOSE : referred to the Singapore meeting in 1984 and suggested that identifying doomed populations ought to be done on a rational basis and should take into account :

(a) the immediate threats to the habitat,
(b) the immediate threats to the animal,
(c) an assessment of the long term prospects of the area,
(d) its capacity to support viable populations for the long term.

He stressed the need to arrive at a clear definition of what constituated a "doomed" population, in terms of habitat size or threat. This he added, was an important aspect of the Global Action Plan that should be developed so that doomed populations could be identified. The primary responsibility rests with the Government of the country but the SSC/ARSG must provide guidelines, advice and oversight. He recommended tha appointment of a sub-committee to develop a Master Plan.

KHAN : mentioned that the problem of "doomed" populations was a more important issue at this meeting than the Master Plan. He added that the Governments must have flexibility. ARSG could develop the Master Plan when necessary, but he agreed on the appointment of a sub-committee for this purpose should this became essential. The priority was to define "doomed" populations and he therefore asked that a sub-committee be formed to deal with this issue.

FOOSE : volunteered to be involved in this sub-committee, and the names of Raleigh Blouch (WWF) and S.R. Widodo (PHPA) were added. Foose wanted the matter settled within a month, while Nardelli and Rubini wanted the matter resolved then and there.

BLOUCH : cautioned that the preparation of the final document should be given sufficient time and consideration and therefore should not be rushed. In the interim however, a rough draft could be prepared as a guideline.

MANAN : pointed out that item 5 (a) in the Singapore proposals was in any case flexible, but added that it should be refined constantly. He suggested inclusion of the phrase, "subject to Government approval" in item 5 (a).

WIDODO : referring to "doomed" populations, advised against rushing into quick decisions without proper consideration of all the factors. The situation according to him was likely to change, since no condition was permanent. The concept of carrying capacity is a complex issue. More studies are needed *before* a population is declared "doomed". He therefore recommended seeking the avaice of Dr. Schenkel who is an authority on the rhino. He further added that in general most Governments had good policies to conserve wildlife. Torgamba was a case in point. In respect of other areas, he said it would be difficult to identify the "doomed" populations themselves. He agreed with Dr. Foose that proper guidelines should be given for deciding what populations without prior studies.

NARDELLI : pointed out that the purpose was to suggest the factors that could aid in the formulation of a definition of "doomed" populations and not to identify the populations themselves. He agreed with Dr. Foose that proper guidelines should be given for deciding what populations were doomed.

WIDODO : feared that once the habitat was doomed, simply labelling the rhino population within as "doomed" would not in itself be enough. So far, he added that no one had ever suggested as to how such "doomed" populations could be salvaged to let them survive in the wild. Something must be done to save the animals and enhance their chances of survival in these areas rather than simply removing them for breeding in captivity.

ANDAU : mentioned that in the long run, the final decision rested with the Government. It must be very flexible to take into consideration the local conditions and enable the Government to act rationally. He doubted if Governments had any deliberate policy to abuse the loopholes (if any) in the agreement, and would go against the conservation ethics. He therefore recommended that only guidelines be formulated.

KHAN : pointed out that the item 5 (a) in the Singapore proposals already provided a useful general framework. He added that the general guidelines were peferable to specific recommendations. The sub-committee would look into the specifics.

RUBINI : summed up the mood and indicated that the word "doomed" be left as it was for the time being !

THE CHAIRMAN'S RECOMMENDATIONS

KHAN : first considered the case of the Sumatran rhino in Indonesia. The animal is found in the National Parks such as Gunung Leuser, Kerinci-Seblat, and Barisan Selatan. It also occurs in the Torgamba production forest and in Kalimantan (north of Kutai National Park), and other areas.

RUBINI : recommended a consideration of the species and its attributes in a logical sequence such as :

1. its geographical distribution in Sumatra,
2. status of the habitats where the animal occurs,
3. conservation programmes (Singapore Proposals format: training, *in situ* & *ex situ* measures)
4. aspects concerning international cooperation

KHAN : considered first the geographical distribution of the Sumatran rhino in Indonesia. The animal occurs in Gunung Leuser, north of Gunung Leuser, Kerinci-Seblat, Torgamba, Gunung Patah, Gunung Rajamandara, and Barisan Selatan. Conservation actions are :

1. continued protection and monitoring of the populations,
2. improved management of parks and reserves
3. development and management of buffer zones
4. proper funding from both local and international agencies
5. initiating and conducting regular surveys of the reserves (at leas once a year).

Kerinci-Seblat National Park is listed in the ASEAN Heritage Areas. Action needed :

1. study of the distribution and number of rhino,
2. strengthen its status as a National Park,
3. carry out regular surveys once a year,
4. give high priority to funding and seek international assistance.

WIDODO : pointed out that the southern part of the Barisan Selatan National Park in southern Sumatra was an ideal habitat for the rhino, and so needed more investment (in terms of increased manpower and finance), to bring about a more efficient management. He was confident that with proper management, the rhino numbers would increase.

ROEDJAI : interjected with the query whether it would be possible to alter the status of Torgamba Production forest to that of a Protection forest ?

KHAN : "Surveys are needed to confirm the presence of rhino especially in the Batu Muda Catchment area north of Kutai National Park, where some animals are supposed to be present. Surveys are also needed in Sarawak/Kalimantan border areas to determine the status of the rhino. Kutai National Park itself needs a re-assessment to determine the status of the rhino"

SINGHAPANT : In Thailand, rhino may be present in the following areas :

1. Huay Kha Khaeng near the Burma border,
2. Thung Yai,
3. Belum in the south, along the Malaysian border

"Surveys are needed to ascertain if rhino is present in (1) and (2). In respect of (3), there is evidence that Sumatran rhino survives here.Improved protection is needed and continued monitoring is planned. This area has a high priority and so it will be declared a reserve soon. Funds are needed but from where will they come ?"

KHAN : He referred to the possible localities in Burma where the Sumatran rhino was likely to occur. He added that very little information was available to help formulate any meaningful management policies.

KHAN : as far as Indochina was concerned, he referred to the report prepared by Dr. John MacKinnon concerning the presence of 4-5 Javan rhino in Vietnam. He added that a survey was urgently needed here in order to get more information.

KHAN : Concerning the situation in India, he recollected that in 1979, there was a decision to re-introduce a number of Indian rhino to its former habitats in India. This was subsequently carried out successfully in the Dudhwa National Park. Nevertheless poaching still remains a serious problem in India, where according to a recent WWF report, about 223 animals were killed between 1982 - 1985.

DISCUSSION ON CAPTIVE BREEDING

BLOUCH pointed out that in the 30,000 ha Torgamba Production forest there were about 10 Sumatran rhino. He recommended that the capture operations be moved to another area. Answering Ir. Roedjai's query whether the status of Torgamba could be changed to Protection forest, he replied that Torgamba would be unsuitable in any case as a reserve. He added that the Barakas Goodwin Timber area just north west of Torgamba could be a possible area for future capture operations. Since 1984, there had been no information about rhino from this area. But prior to that date, rhino were killed there.

NARDELLI : urged that the advice given by Mr. Blouch be heeded and capture operations be shifted to a new area.

RUBINI : mentioned that more objective surveys were needed, and added that such surveys were better carried out by WWF in association with tha Forestry personnel. He recognised the need to obtain both funds and expertise from International agencies such as IUCN, WWF and from Howletts & Port Lympne Zoo Park (HPLZP). He recommended that HPLZP continued their operations in Riau province while the AAZPA (if and when they participated in the programme) concentrated on other

areas in Sumatra.

NARDELLI : pointed out that logging still went on in the Barakas Goodwin Timber area (50,000 ha) where a large net work of roads had been created. He added that surveys were needed before recommendations could be made.

FOOSE : mentioned the need to agree on the number of animals needed for the captive breeding programme. He then suggested a figure of 30 individuals (15 pairs) as the minimum needed. Of the 15 pairs, 3 pairs would be in Malaysia, 4 pairs in Indonesia, 1 pair in Thailand, 2 pairs in the UK and the rest (5 pairs) in USA.

WIDODO : pointed out that there would be mortality associated with the capture of these "minimum" number of 30 rhinos and so in effect perhaps 40 must be captured to get this minimum number, making allowance for any losses during the operations. Furthermore, he added that the sex ratio might be unbalanced, so that much more than 30 animals would have to be captured in order to get the balanced sex ratio. He recommended a conservative number - say 10 pairs - as being adequate for the captive breeding programme.

BLOUCH : agreed with Mr. Andau that it was better to leave the number flexible. The number would depend on the availability of "doomed" areas and it should not be simply a target to be met by capturing rhinos anywhere.

RUBINI : recommended that the decision to capture some Javan rhino for either breeding in captivity or translocation to a second home be postponed to a later date. He hoped that IUCN would cooperate with Indonesia in carrying out more research.

NARDELLI : also emphasised the need for research in Ujung Kulon, particularly in determining if there was any serious competition between the banteng and the rhino. He was optimistic that funds could be made available.

RECOMMENDATIONS

MADE AT THE IV MEETING OF THE IUCN/SSC ASIAN RHINO SPECIALIST GROUP

13 - 14 October 1986
Jakarta, Indonesia

(The Singapore Proposals with appropriate modifications)

1. The primary goal is long term survival of the Sumatran rhino as a species and a component of natural ecosystems.
2. A comprehensive masterplan for conservation of the species will be developed, which will be collaborative and multinational in nature and which will identify and integrate all of the actions necessary to achieve the primary goal.
3. Development and oversight of the masterplan will be the responsibility of the SSC/Asian Rhino Specialist Group.
4. The conservation programme will include the following three fundamental activities :
   (a) Develop an educational programme to enhance public awareness and support for the Sumatran rhinoceros.
   (b) Provide primary support for a programme of conservation of the Sumatran rhinoceros as viable populations in sufficiently large areas of protected habitat.
   (c) Establish a captive breeding programme for the preservation of the genetic diversity of the Sumatran rhinoceros in the countries of origin, among others Indonesia, Malaysia and Thailand, and in North America and Europe, using animals with no hope of survival in the wild.

   The parties are committed to contribute to each of these in each country as mutually agreed, with details subsequently recorded in a bilateral memorandum of understanding or similar document.
5. The following principles and actions are to be observed in the captive propagation programme :
   (a) Animals selected for capture in the wild are to be "doomed" individuals or come from "doomed" populations or habitats; that is, those whose future long term viability or contribution to the survival of the species is determined to be unsatisfactory as measured

by objective criteria subject to continuing refinement.

(b) Currently presumed subspecies stocks will not be mixed, either in captive breeding or in the wild translocation until further work is done on their taxonomy.

(c) The Zoo communities will provide support and technical assistance in field capture and transfer operations.

(d) Bilateral agreements will provide for captive breeding programmes in the countries of origin as well as in the US and UK.

(e) Animals sent abroad will be on breeding loan from the countries of origin, or under some similarly equitable ownership agreement of sufficient time span to protect all interest.

(f) All animals placed in captivity and their future progeny will be managed coperatively as part of a "world population" in the light of the primary overall goal of the programme. Decisions will be taken by consultation among the owners and interested parties with oversight by the SSC/Asian Rhino Specialist Group.

(g) Bilateral agreements will provide for appropriate support, training and technical assistance in captive breeding in the countries of origin.

CLOSING ADDRESS

Dr. RUBINI ATMAWIDJAJA
Director—General
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Nature Conservation
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Ladies and Gentlemen,

I must express my thanks to everyone here for contributing to an excellent meeting with a series of well prepared, thoughful and relevant papers which stimulated most useful discussion. You can be certain that these deliberations will help us enormously in our efforts to conserve the two species of rhinoceros here in Indonesia.

We can be encouraged by the fact that much has already been achieved. The Directorate of Forest Protection and Nature Conservation (PHPA) has been able to bring down poaching on Javan rhino in Ujung Kulon National Park to a very low level by improving security. In fact we have lost only one rhino there through poaching in the last five years. Protection of the Sumatran rhino is inherently more difficult as its population is scattered over a much larger area and the PHPA has only very limited financial and manpower resources to effectively deal with the protection of the rhino and its habitats. Nevertheless the situation in this case too has greatly improved.

When looking to the future, we must keep in mind that the goal must be the maintenance of the two species in perpetuity and that the primary need in this respect is the maintenance of adequate, well protected habitats where the animals can live. We must accept the fact, however regrettable it may be, that for the forseeable future, the financial incentive for the intending poacher will remain very high. Therefore, it is even more important that the reserves where the rhinos live shall be substantial in area and are not at risk of fragmentation into small, unviable units. The areas must therefore be large enough to hold significant populations and easy enough to guard against intruders. It is therefore essential that land-use planning for economic development becomes more sophisticated, taking into account the wildlife needs, from the outset and by proper use of environmental impact analysis.

However it is inevitable that some wildlife habitat will be lost, and with international cooperation, there has been, as you have heard at this meeting, a most encouraging start to translocating Sumatran rhinos from an area where their continued survival in the wild is problematical, and using the animals to establish captive breeding programmes both here in Indonesia and in the United Kingdom. The strategy to be adopted for increasing the numbers and range of the Javan rhino is much more difficult. The carrying capacity of Ujung Kulon peninsula is uncertain. If the population there is left alone, the slow rise in numbers believed to have occured in recent decades may continue, but it is possible that the carrying capacity has already been reached. At the current level of population, it would be taking a big risk to attempt the removal of a section of the population for breeding in captivity, given the lack of experience of maintaining and breeding this species under zoo conditions.

However, there are many aspects and problems to consider and a decision on the matter can only be taken after thorough consideration of all the options. We are still ignorant about several aspects of the rhino and so a priority should be more research both in the field as well as in the zoos. A sound scientific understanding of the ecological requirements of the rhino is fundamental to any management programme designed for its conservation. On this I am sure you all will agree.

Finally, I would like to thank you all for your participation which made this meeting worthwhile and interesting. To the Chairman, Mr. Mohammed Khan, I would like to express my special thanks for his help and enthusiasm in making this meeting a success. On this optimistic note of progress for the future, I will close the meeting.

CLOSING ADDRESS

Mr. MODH. KHAN BIN MOMIN KHAN
Chairman
IUCN/SSC Asian Rhino Specialist Group

Editors' summary

Mr. Mohd. Khan thanked the Government of Indonesia and Prof. Rubini for the excellent arrangements and the generous hospitality provided during the meeting. He added that it was a fruitful meeting with much discussion over the situation of the rhinos in Indonesia, Malaysia and Thailand. More information is currently available than before on the rhinos. The establishment of the Tabin Wildlife Reserve in Sabah is particularly a most welcome development, and it augurs well for the future of wildlife conservation. However problems still remain especially over the lack of funds and extension work. He regretted that Sarawak was not given more attention at this meeting but was delighted at the news that there were some rhinos in that state. He added that in Thailand too the Sumatran rhino was once very numerous but today, it had almost disappeared. Perhaps there are still a few along the Burma/Thailand and Malaysia/Thailand borders? Burma remains an enigma! Very little is known about the distribution and number of rhino from Burma. He hoped that IUCN/WWF could be persuaded to initiate some programmes in Burma, Laos, Vietnam and Kampuchea. He stressed the need to convince the Governments in implementing the recommendations arrived at this meeting within the framework of human problems and interests. He added that money is made available through the exploitation of our land resources in logging, mining oil extraction etc, and therefore conservation efforts should not come into direct conflict with economic development, instead conservation and development should complement each other. He expressed his optimism that this was possible and finished his closing address with renewed thanks and appreciation for the hospitality of Indonesians.

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PERSATUAN PEMINAT DAN AHLI KEHUTANAN (PPAK)

PERSATUAN PEMINAT DAN AHLI KEHUTANAN (PPAK), didirikan di Bogor pada tanggal 9 Juni 1952. Persatuan ini berasaskan Pancasila. Tujuan Persatuan adalah mengikut sertakan hutan dan kehutanan dalam mencapai masyarakat yang adil dan makmur, dengan jalan:

a. Mengabdikan, memperkembangkan dan mengamalkan ilmu pengetahuan kehutanan guna menggali sumber kekayaan alam Indonesia untuk sebesar-besarnya kemakmuran rakyat.
b. Ikut serta secara aktif mempertinggi mutu pengetahuan warga kehutanan.
c. Memperbesar adanya perhatian dan pengertian masyarakat terhadap hutan dan faedahnya.

Untuk mencapai tujuan tersebut PPAK menyelenggarakan usaha-usaha sebagai berikut :

a. Ikut serta secara aktif dalam segala usaha pembangunan negara.
b. Menyelenggarakan usaha-usaha penyuluhan dan survai dalam rangka pembangunan.
c. Menyelenggarakan penerbitan-penerbitan ilmiah kehutanan.
d. Mengadakan pertemuan-pertemuan dan musyawarah.
e. Usaha-usaha lain yang syah.

Anggauta-anggauta PPAK terdiri dari para rimbawan, peminat dan ahli kehutanan.

RIMBA INDONESIA yang diterbitkan oleh PPAK adalah majalah ilmu Kehutanan, diterbitkan pertama kali dalam bulan Agustus 1952. Sampai dengan tahun ke 8 (1959) merupakan majalah bulanan dan sejak tahun ke 9 (1964) diterbitkan tiga bulan sekali dengan nomor 1 sampai dengan 4 tiap tahun. Dalam tahun-tahun 1960 — 1963 dan 1976 — 1983, Rimba Indonesia tidak diterbitkan.

KARANGAN untuk Rimba Indonesia pada dasarnya harus dibuat dalam bahasa Indonesia dengan disertai ringkasan dalam bahasa Inggris (English summary). Karangan yang dapat dimuat hanyalah karangan asli yang tidak pernah atau tidak akan dimuat dalam majalah lain. Redaksi tidak bertanggung jawab terhadap pernyataan dan pendapat penulis dan berhak untuk menolak atau menerima setiap karangan serta mengadakan perubahan-perubahan redaksional, pemendekan dan penyesuaian judul yang diperlukan tanpa berkewajiban memberitahukan alasan-alasannya. Jika diminta, penulis karangan dapat diberi dengan cuma-cuma 25 buah cetakan lebih dari tulisannya yang dimuat.

PERSATUAN PEMINAT DAN AHLI KEHUTANAN (PPAK) is an official name of the Indonesian Forestry Association and was founded at Bogor on June 9, 1952. The objectives of the association are to promote forestry science; to raise the standard of forestry profession; to keep the knowledge of the foresters up to date; to arouse public interest on the importance of forest for the society. The activities of the association include: publication of journals, holding of conferences, discussions. Membership is open to foresters or persons actively engaged in forestry profession and to those interested in forestry.

RIMBA INDONESIA published by the association is a forestry journal established in August, 1952. Until Vol VIII (1959) it formed a monthly periodical and starting with Vol IX (1964) it appeared quarterly, numbering from 1 to 4 each year. The publication was suspended during the period 1960 — 1963 and 1976 — 1983.

CONTRIBUTIONS from outside Indonesia are welcome provided that the articles deal with matters of concern to forestry profession in Indonesia and are presented and with a summari in English, which will be translated into Indonesian by the editor. The editor does not hold itself responsible for the statements and opinions expressed by the authors and has the right of accepting or rejecting any articles or of making suitable alterations. No article should be submitted while is being offered to any other journals for prior or simultaneous publication. On request the authors will be supplied with twenty five reprints of their contributions published in the journal.

PETUNJUK BAGI PENULIS KARANGAN

Judul karangan harus pendek dan sesuai dengan isi karangan.

Nama Penulis disertai instansi tempat bekerjanya ditulis dibawah judul karangan.

Ringkasan (summary) ditulis langsung dibawah judul karangan dan nama penulis dan harus memuat inti sari dari seluruh karangan, maksimum terdiri 250 kata. Summary, jika diminta, dapat dibuat oleh redaksi atas dasar ringkasan dalam bahasa Indonesia yang dibuat oleh penulis.

Pendahuluan sebaiknya memuat tujuan umum dari karangan serta luasnya dan pentingnya persoalan yang dikemukakan.

Naskah harus ditik dengan spasi rangkap pada satu halaman dari kertas tik yang berukuran folio. Sisi-sisi sebelah kiri, atas dan bawah dikosongkan selebar berturut-turut 7, 3 dan 3 cm. Naskah dikirim rangkap dua.

Gambar dan potret sedapat mungkin dibatasi jumlahnya dan ukuran sesuai dengan ukuran majalah (16 x 24 cm). Tulisan dengan potlot tinta atau mesin tik dibelakang gambar atau potret, demikian pula penempelan yang dapat mengakibatkan lubang harus dihindarkan. Potret harus dicetak hitam putih pada kertas mengkilap dan menunjukkan kontras. Gambar-gambar termasuk grafik harus dibuat dengan tinta cina pada kertas putih dan tebal. Apabila dipergunakan kertas grafik, sebaiknya yang bergaris-garis hitam diatas dasar putih. Keterangan gambar atau potret ditik dalam naskah dibawah tempat dimana gambar atau potret akan dimuat.

Pustaka yang dipergunakan diberikan dalam bentuk daftar pada akhir karangan yang disusun menurut abjad nama penulis dan tanpa nomor urut. Petunjuk pustaka didalam naskah diberikan dengan nama penulis dan tahun karangannya. Apabila dari seorang penulis dipergunakan dua atau lebih karangannya yang diterbitkan dalam tahun yang sama, maka dibelakang tahun disertakan huruf-huruf a, b, c dan seterusnya sesuai dengan urutan penerbitannya. Bila terdapat lebih dari dua penulis, maka hanya penulis senior yang disebutkan dengan singkatan *et al.* di dalam text karangan. Contoh: Daniel *et al.* 1979. Di dalam daftar pustaka diterakan nama lengkap penulis, tahun penerbitan dengan diikuti - apabila ada - huruf a atau b atau c dan seterusnya, judul karangan, nama penerbitan (majalah), pengumuman dan lain sebagainya, nomor jilid, nomor penerbitan, nomor halaman sebagai berikut:
Sudiono, J. dan R.I. Ardikusumah, 1967. Suatu hasil percobaan penanaman *Shorea stenoptera* Burck. Rimba Indonesia 12 (1): 47 — 56.

Apabila Pustaka yang dipergunakan berupa buku (textbook), maka yang diterakan nama penulis, tahun penerbitan, nama buku, nomor jilid, (apabila ada) nomor edisi, nama dan tempat penerbit, sebagai berikut:
Spurr, S.H. and B.V. Barnes. 1980. Forest Ecology. 3rd. ed., John Wiley and Sons, New York.

Pemeriksaan dan pembetulan yang diinginkan oleh penulis harus sudah diadakan pada naskah sebelum dikirimkan. Dalam pemeriksaan perlu diperhatikan tanda-tanda baca, sehingga pembaca dapat mudah memahami yang dimaksudkan oleh penulis.

Huruf-huruf besar harus dipergunakan dalam menulis judul karangan dan judul bab. Nama ilmiah dari tumbuh-tumbuhan dan binatang diberi garis bawah, demikian pula hal-hal yang dianggap penting.